The electro-therapeutic guide ; or, A thousand questions asked and answered / by Homer Clark Bennett.

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The Electro-Therapeutic Guide

HOMER CLARK BENNETT

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The Electro-Therapeutic Guide

OR

A Thousand Questions Asked and Answered

BY

HOMER CLARK BENNETT

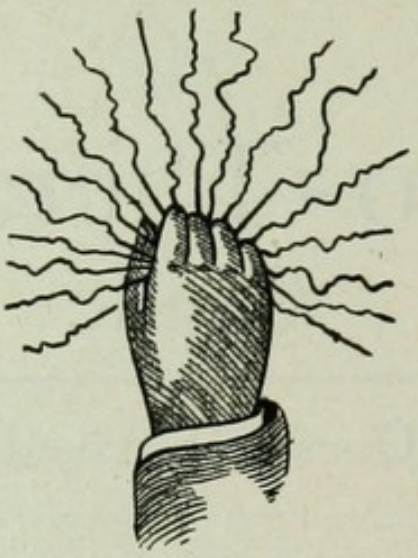
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Author of a Mail Course of thirty lessons in
Electro - Therapeutics
Lima, Ohio
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NINTH EDITION, REVISED AND ENLARGED

Containing 425 Illustrations

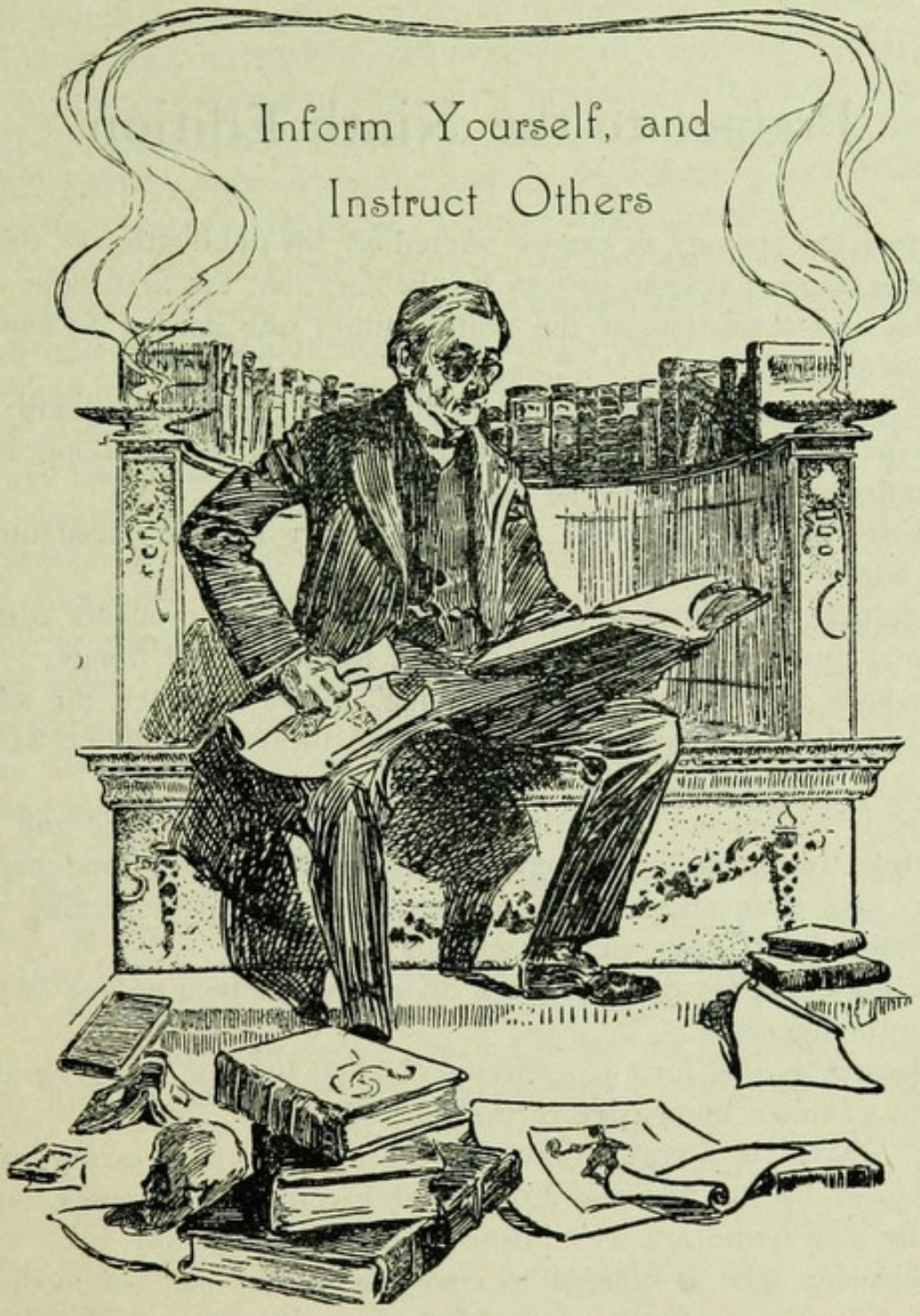
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National College of Electro-Therapeutics
Lima, Ohio, U. S. A.



TENEO—TENEOR

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The best way to get this "know how" is to take the mail course of instruction from
The National College of Electro-Therapeutics, Lima, O.

Preface to the Ninth Edition

There is no apology or excuse offered for the publication of this book, but there is a good reason, proven by the fact that the first eight editions were sold, and a portion of the ninth edition was needed to supply the advance demand.

One important improvement is that the electro-therapeutic index, formerly part two, is now placed in front as part one, making it easier to find and consult. This is the real guide.

Both the therapeutic index and the glossary have received numerous valuable additions.

Much that was obsolete and unnecessary in the previous editions is omitted and replaced by new, recent ideas, technique and things.

This book is an aid, and a real "guide" to the beginner, the advanced student and the busy doctor, to refresh his memory, without having to wait.

There is a tendency toward proliferation, in the number and size of books, while this book is different. It concentrates ideas and condenses words, to save time and energy, so that the busy operator may get the proper "know how" both quickly and accurately.

This work will not take the place of text books, or a course of lessons, on electro-therapeutics.

This work is not for the expert specialist, but for the general practician with a limited knowledge of the subject.

This "guide" is a corollary to and part of the mail course of thirty lessons, issued by the National College of Electro-Therapeutics, but is in demand by many who are well informed in electro-therapy.

A physician who is obliged to cover the entire field of medical and surgical practice can not be expected to keep in mind all the details of technique of electro-therapeutic practice, and the therapeutic index part is arranged in abbreviated form, so that it may be seen at a glance, the best, or a variety of methods of treatments that may be applied in any particular case, which it is desired to treat by this agency.

The usual stilted forms of didactic language, obscure phraseology and technical terms have been eliminated, and the Socratic conversational style of questions and answers adopted, as the most easily understood and conveying the ideas of the fundamental principles, so they will be remembered.

For a full and complete outline of the subject, the reader is referred to, and is strongly advised to consult, the mail course of lessons, but this book contains the essence of the course of nearly a thousand pages (fully illustrated), without any useless words, and this guide will save much time and insure a more scientific and successful use of electrification as a therapeutic agent in the hands of the average physician.

In the following suggestions as to the treatments outlined, an intelligent physician will take into consideration the general physical condition, age, sex and individual idiosyncrasies of the patient.

Thousands of physicians, who would not devote their time to a thorough study of electro-therapeutics from large text-books, or who could not take post-graduate courses of personal instruction, have by the aid of the mail course of lessons, and the "Guide," been able to apply electrification, in a scientific and successful manner, and have secured results impossible without the knowledge therefrom.

No originality is claimed in the methods of treatments advised, but the ideas are derived from twenty-five years' close study of nearly every publication on the subject, and the results, observations and conclusions from practical applications of the agency, during that time, and the general rules laid down, and the technique suggested, accord with the ablest specialists in electro-therapeutics.

If this work will assist the busy practician and guide him to proper methods of application of electrification in therapy of diseased conditions, thus securing good results, instead of failures; if it will interest him in the subject of scientific electro-therapeutics and stimulate his desire for accurate knowledge, and cause him to give more careful attention to this important branch of practice, then the author will be satisfied.

H. C. B.

INTRODUCTORY

ELECTRO-THERAPEUTICS AS A SPECIALTY FOR THE GENERAL PRACTICIAN

Specialism is the order of the day. The time is past when one man can do it all. In this era, the doctor to succeed must excel in something. He must know something about everything, and must endeavor to know everything about some one thing. That branch to which he is most attracted will be one to which he will devote the most time and study, and it will be naturally followed up, and if he masters the details and technique of that branch, then he will have the best success with it, and this will eventually become his specialty. Some specialties are forced upon physicians against their will by circumstances, but the most of them are at liberty to select the special line of study most congenial to their tastes, and best adapted to their ability and field work. The physician should first, however, have the invaluable schooling only acquired in general practice, without which the specialist is handicapped, so that specialists are not made all at once. Electro-Therapeutics is now firmly established as a branch of medicine. Electrification has its uses and limitations as a medicine. It is not a cure-all, but when scientifically applied in selected cases it will do things that nothing else will. The chief danger in the use of electro-therapeutics is not the agent itself, but in the person using it. If ignorantly or carelessly applied, it may and often does do harm, and brings disappointment, whereas, if rightly and intelligently used, it gives uniform satisfaction and brings success. It is an axiom that a power for good when rightly used is as great a power for harm when wrongly used, in proportion to its potential, and this applies strongly to electro-therapeutics. Electrification must not be applied by guess. The laws of its operation must be understood, therefore a preliminary education in electro-therapeutics is an absolute essential to success. Correct technique is everything. There are many doctors who have the idea that all that is required is a battery and a few directions.

There is just as much sense in this belief as there is to say that all that is required to make a doctor is a stock of drugs and a few instruments. It is just as necessary to understand the physics, chemism and physiological effects of electrification as it is to understand the same of any other medicine.

Doctors are awakening rapidly to the fact that they must have something besides a battery, and must have at least a working knowledge of it and its uses. This knowledge can be obtained by experience, study and experiment, but at what a cost of time, money and disappointment! There are many books published on the subject for sale now, of more or less value to the operator, but of more value to the specialist as a reference. The majority of physicians are too busy to leave their homes and practice to take a special course, yet they feel the vital need of more knowledge in electro-therapeutics. They are busy and have little or no time to devote to experiment, and the knowledge to be gained from the average text-book on the subject is, to say the least, unsatisfactory, therefore, there is an absolute need for a simple, practical mail course of instruction in electro-therapeutics, which the busy doctor can take at home, and which at the same time will give him just the information he needs concerning the apparatus to be used, the nature and effects of the different modes, and the simple facts plainly stated, to guard him against mistakes and guide him in the right direction in medical electrification.

Such a course has been prepared by The National College of Electro-Therapeutics, Lima, Ohio, which is the oldest school of its kind in the world, having been chartered in 1896, and which course is now in its fifth edition, and consists of thirty thirty-two-page lessons, covering the entire field of electro- radio-, magneto, and photo-therapy, and to which course this "guide" is a corollary. The lessons are profusely illustrated and plainly and concisely written and teach electro-therapeutics in a practical manner, and all should take them.

The question is often asked by general practicians whether the ends will justify the means, for them to equip themselves with proper batteries, and use the same in their general practice. To such we reply that if they once become posted and apply electrification with the same care that they would any other medicine, the ends will ALWAYS justify the means, and a GOOD battery is one of the best assistants the busy doctor can have, and when they once begin to look for places to apply it they will never cease finding openings where it will be of great assistance to them, both professionally and financially. The general practician can make a specialty of electro-therapeutics without necessarily confining himself to it as a specialty. The great majority of the alumni of the National College of

Electro-Therapeutics are busy doctors in general practice, many of them in country practice. We have one doctor in mind, over sixty-five years of age, doing general practice, and in a village of 700, who has an office equipment of electro-therapeutic apparatus costing over one thousand dollars, which he has made pay for itself many times over in the last few years, and with which he is now busy all the time in his office, having relegated the outside work to his son. We know of other doctors equally well equipped in locations ranging from small villages to large cities, all of whom are succeeding in electro-therapeutics. The field of application is so large and the indications for the use of electrification as a medicine so plentiful and the results following its uses so satisfactory that when once in the field, they invariably stay with it. One of our students became so enthusiastic recently that he wrote that he had decided to abandon practice of medicine entirely, and devote himself exclusively to electro-therapeutics, as he had found a remedy that would meet all his needs. We were sorry to do it, but we had to throw a cold blanket over his enthusiasm because electrification is not a cure-all, and will not take the place of all other remedies, but should be used in conjunction with other means and methods of treatment wherever and whenever indicated, only applying electrification when it seems most indicated, just as you would any other form of treatment. Enthusiasts are all right, but sometimes they overdo it, and make promises they cannot fulfill, and often disappoint themselves and patient. A wise discrimination is necessary to successful therapeutics. The day is coming when the true physician will not be hampered by a limitation of schools, pathies, isms or narrow dogmas, but will, like the bee, gather honey from all the flowers, and appropriate and use only the best from each; in other words, the coming doctor will treat his patients with whatever he thinks will relieve or cure most safely, quickly and pleasantly, whether it be drugs of large or small doses, or no dose at all, mass or active principle, baths, massage, electrification, light, heat, vibration, diet, hygiene, exercise, rest, suggestion, sunshine or moonshine. The doctor who is not posted in electro-therapeutics will seldom see any indications for its use, while the doctor who is well acquainted with its properties and power will be always finding cases in which it can be applied with great advantage, as there is scarcely any limitation to its usefulness in some way or other. In this rapid age, where most of us are nervous dyspeptics, electro-therapeutics has a great field for usefulness. The combination of nervous unbalance, termed Americanitis, especially calls for the soothing application of electrification to restore the normal equilibrium.

General Electro-Therapeutics

It will be my aim all through the following pages to answer the most important questions concerning the underlying principles, or fundamental facts, concerning the science of electrification, in all the various modalities, or in other words to lay a solid foundation on which to base the system of therapeutic applications, which we are now about to take up in detail in the special electro-therapeutic index. With the proper care in the preliminary preparation, we will be able to go ahead intelligently, and can show a "reason in our madness," and by applying the known and fixed laws governing the science, we can be reasonably sure of getting satisfactory returns, and a uniformity of results, which will bring both success to us, and relief to our patients.

Some of you no doubt wonder why we are so slow in getting to the practical therapeutics of the guide, but the experience of years of teaching and practice, when we had no one to teach us except the slow, painful, expensive and valuable school of experience, has shown to us conclusively, that it is far better to go ahead slowly, and be sure, than to "rush in where angels fear to tread," and make mistakes, and fail. If you will thoroughly digest the next few pages, then we can leave you alone with the problem of therapeutics, feeling sure that you could "work out your own salvation," without fear and trembling, but as we are all human, and liable to mistakes and to forget, we have prepared a condensed outline of electro-therapeutics, which takes up the exact details of the technique, of all of the known indications for electrification as a therapeutic agent. This is especially for the busy practician and intended to help his forgettory.

Science is the sum of demonstrated facts, and we have endeavored to place before you, in a simple language, and a clear and concise manner, the series of electric facts which have been demonstrated.

Knowing these facts, and the laws governing the production of the phenomena, the application of them is easy, and the practical technique follows a logical sequence. However, we will now proceed to go more into detail, in the treatment of some of the general constitutional and local diseases, and give special technique in those conditions which will most frequently confront the beginner, and bring the best results.

As this book deals entirely with electro-therapeutics we shall not enter into the etiology of disease, or the pathological conditions, or the medical treatment of the case.

We take it for granted that the physician who reads this book, has carefully studied the course of thirty lessons in electro-therapeutics from the National College of Electro-Therapeutics, Lima, Ohio, to which this guide is but a corollary or supplement, and has correctly diagnosed the case to be treated; that he recognizes the pathological conditions and is familiar with the medical treatment of the case.

It should be understood that no kind of electrical treatment contra-indicates the use of internal or local medication, or the use of such adjuvants as massage, baths, exercise, diet, etc.

It is frequently advisable to combine these methods with electrical treatment.

In outlining a definite line of treatment for each disease, which we shall now do, it should not be necessary to explain in minute detail the method of supplying a certain line of treatment, if the following pages devoted to questions and answers and the course of thirty lessons have been carefully studied and remembered. For example, if general faradization or central galvanization is the treatment recommended, we cannot specify in each individual disease where to hold the positive and where the negative pole, or whether to use the primary or secondary coil.

In each case the physician should understand whether a sedative or a stimulating effect is desired, and the following pages or lessons have told him how to secure either sedation or stimulation, with either general faradization or central galvanization.

It should not be necessary for us to state in each disease where the faradic battery is used whether the primary or secondary coil should be used, but the difference in effect between the two coils and where each

should be used, is fully set forth in the following pages devoted to questions and answers, and if you are not fully posted, or have forgotten, then it is advised that that part of this guide be well studied before treatment is attempted.

We will, however, at the risk of repetition, "to make assurance doubly sure," state a few facts which will, if remembered, be a sufficient guide for the subsequent pages.

The following facts are important in every case treated; not one of them should be forgotten.

CONDENSED FACTS FOR THE GENERAL PRACTICIAN WHO USES ELECTRIFICATION

P. P. P.—Positive pole for pain.
Electrolysis is chemical, galvanic only.
Phoresis is mechanical, galvanic and static.
Catalysis is physiological, galvanic, faradic, static.
Never use a bare metal electrode on the dry skin.
The faradic has a mechanical and catalytic action.
The galvanic is the only mode having a chemical action.
Mild doses only should be applied to sensitive parts.
The best method of irritation is by rapid change of polarity.
Use iodine preparations under negative pole in cataphoresis.
Use cocaine and alkaloids under positive pole in anaphoresis.
All modes and either pole have a great influence upon nutrition.
Do not make long exposures to the X-ray, with tube close to patient.
Never leave a galvanic or faradic battery turned on, or short-circuited.

The battery should be in a condition to run continuously during treatment.

The electrodes should always be in position before the mode is turned on.

Don't try experiments on patients. Try them first on yourself and see how it goes.

It must be remembered that for treatment, a mild dose for a long time is more efficient and agreeable than a strong dose for a short time.

Frequent interruptions of the mode or changes of polarity intensify the effect of the mode and are often necessary to relax tense muscles, etc.

The static mode is silent, continuous, in same direction, no shock, generated by induction, has low amperage, high voltage, no chemical action.

The static induced is interrupted, but is unidirectional, but intermittent, is induced, has low amperage, high voltage, no chemical action.

In voluntary muscles, contractions are produced immediately upon applying mode, and at the end of the treatment they return to their normal condition.

The primary coil gives more a mode of quantity and produces more violent muscular contractions, but lacks the penetrating power of the secondary coil mode.

Galvanization of the sympathetic influences the vaso-motor and trophic processes of the brain and spinal cord, the face, eyes, muscles, skin and many parts of the body.

The galvanic mode will stimulate the absorbents more powerfully than the faradic, and is the one to use in removing hypertrophies, morbid growths, effusions, etc.

Don't let female patients take static crown breeze with hats on or with wire or celluloid pins or combs in hair, as the wire is painful and the celluloid may explode and burn the hair.

It is frequently advisable, in addition to treating the diseased part itself, to apply the treatment to adjacent parts, to act upon the circulation and nutrition of the diseased parts.

If your battery or machine don't work, hunt for the trouble till you find it, and see if it is not more your own fault than that of the apparatus. "If at first you don't succeed, try, try again."

The positive pole is acid, liberates oxygen, contracts blood vessels, decreases nutrition, coagulates albumen, corrodes metals, causes dry, white, hard scar, relieves pain and irritation.

The negative pole is alkaline, liberates hydrogen, dilates blood vessels, increases nutrition, does not coagulate albumen or corrode metals, causes no scar, but a moist, red, soft condition, increases pain and irritation.

The galvanic mode is constant, flowing in the same direction, and is silent, without shock, generated by chemical action, has high amperage or strength and low voltage or pressure, has chemical action.

The faradic mode is alternated and interrupted, flowing in opposite direction, is noisy, gives shock, generated by induction, has high voltage or pressure and low amperage or strength, has no chemical action.

The electro-thermal bath is a very excellent method of applying faradization and may be used in any case where this treatment is to be given. The vapor bath of itself is frequently a valuable auxiliary to the electrical treatment.

Good results cannot be secured with a poor battery or improper methods of application. A faradic battery having a small coil of coarse wire produces a crude, harsh mode—lacking power of penetration, and will invariably irritate a nervous patient.

In involuntary muscular fibers, as in the intestines, stomach, œsophagus, contractions are immediately started upon closing the circuit, but the movement when once induced will continue for a considerable time after cessation of the treatment.

The best method of lessening irritability with faradization is to begin with a very mild dose, gradually increase to the highest point that does not produce pain, and after holding in position for a few moments gradually reduce the strength of mode. (Swelling treatment.)

It is not as important in using the faradic mode that attention be paid to polarity, yet it is always advisable to use the positive for the active pole when a sedative effect is desired, and the negative for the active pole when a stimulating or irritating effect is desired.

Observations with a fluoroscope should be made only in a well darkened room. The operator will soon find that the same apparatus which gives only faint outlines, in broad daylight, will show every detail at night or in a dark room, after his eyes have become accustomed to the darkness.

Do not use your hand much in making X-ray tests with the fluoroscope. You may develop an obstinate and dangerous, if not fatal, dermatitis, or necrosis. X-ray effects are cumulative. BEWARE.

The secondary coil produces a greater sedative effect and is a mode of greater tension and penetrating power, hence more applicable to nervous and deeply seated diseases than the primary mode. The finer and longer the wire in the secondary coil, the greater power of penetration and sedation.

In chronic cases it is necessary occasionally to vary the treatment. Where general faradization has accomplished all that it will, general galvanization may produce still further results. Central or general galvanization may fail in a case where general faradization would produce results and effect a cure.

The flowing of electrification from positive (higher), to negative

(lower), is due to "difference of potential." (Potential in electrical parlance means level.) When the "potential is equalized" the battery is inoperative and is said to have "run down." When deleterious action occurs within the cell it is said to "polarize."

Electrification sets in motion forces that continue to act for hours and even days after treatment, hence treatment should not be given too frequently. Nervous diseases in particular may be aggravated by too frequent treatments. Ordinary chronic cases require three or four treatments weekly. Acute or sub-acute cases may require daily treatment. Nothing will be gained by treating cases more than once daily.

The resistance of the skin, which is very great, is diminished by enlarging the electrodes, which allows greater diffusion of mode. If the dose be too strong and applied too long a time at a given place there appears at the positive an eschar from acid reaction. At the negative, ulceration from alkaline reaction. The electrodes should be moistened with a solution of chloride of sodium, which is a better vehicle than water, for the reason that the positive takes the chlorine and the negative takes the sodium corpuscles.

There is scarcely a chronic disease treated with electrification where we cannot trace at least part of the good results of treatment to the effects on nutrition. In the treatment of almost any chronic disease always remember that electrification properly applied will stimulate circulation, and that the increased flow of blood will bring an increased amount of nutrition; that the contraction of muscular tissue produces the same effect as massage or gentle exercise; that nutrition may be effected through a chemical process; that the process of waste and repair may be promoted, and that the nutrition of the entire system may be improved through indirect action as well as by the direct effect of treatment, securing a constitutional, tonic, stimulating effect.

THE SCIENCE OF ELECTRO-THERAPEUTICS

It has been claimed by those whose interests are inimical to advanced therapeutics, that electro-therapeutics is not a science.

Science is the sum of demonstrated facts, and the facts which have been set forth in these pages are capable of demonstration, and, therefore, we make the claim, that *electro-therapeutics is a science.*

This *science* is yet in its swaddling clothes, and it is only a question of time, when it will come forth full fledged and powerful, and be one of the mighty factors in our armamentarium, and an efficient adjunct in treating disease, and in bringing about a restoration of the normal condition of health.

A preliminary knowledge of anatomy, physiology, physics, chemistry and psychology, will make the road of the student of scientific electro-therapeutics much easier to travel, and help him over the rough places and through the short cuts, but as all are not equally fortunate in this respect, we have tried to make up to those who are deficient in these things, in the lessons, and if these have been well mastered, the study of the guide will be easy.

The careful student who has followed the teachings so far, is just at the commencement of his work, and at the threshold of the great store-house of knowledge, from which he may take whatever he can apply, and use to advantage in the broad field of therapeutics.

Theories are fine things, and as theories go, any theory is all right as long as it applies, and is capable of demonstration, but facts are stubborn things, and we are frequently confronted by conditions, not theories, and if things do not always go just as you wish, do not jump at conclusions. Remember that electrification follows fixed laws, and if there is a seeming contradiction, or an apparent paradox, you should set your "thinker" in operation. *There will be a reason somewhere.*

If you leave a switch open, and there is a broken circuit, hunt for the gap and fill it. Do not expect an insensate thing, like a battery, machine or tube, to go contrary to a natural law, because a finite and very fallible operator has made a mistake.

Electrification is a docile and willing servant, when properly handled, but is a stubborn and unyielding master when ordered to act contrary to its fixed rules.

Electrification in its divers manifestations is unexcelled in some things, but it is not as good as other things in many instances, so do not claim that it is a "cure-all." Sometimes it will do what nothing else can, and vice-versa, but it comes as nearly being a universal helper as anything we have at our command.

Judgment, discretion, caution and discrimination must be used both in the selection of the case, and of the choice of the method of application.

Reason, care and prudence will succeed, while hurry, carelessness and guess-work will only bring trouble.

What is worth doing at all, is worth doing well. Be careful of details.

Nothing is too small or unimportant to be neglected or overlooked. Many dismal failures are recorded on the tablets of history, which were due to carelessness or ignorance.

You know the old story, how a nation was lost because of a single little horse-shoe nail.

A slight mistake may cause a shock or a painful sensation, which may frighten or disgust a timid or doubtful patient, and cause him to not only not return, but keep others away, and thus lessen your practice, or ruin your chances of success, while a careful observance of details and wise prevention of the unpleasant things, may start the whole community your way.

It is the little things which make or mar success, and success is by no means a little thing.

Let us all go ahead and make our specialty more perfect, more valuable, more and more needed, more helpful, more respected, more scientific. Let our motto be. "Bonus, Melior, Optimus."

KEY TO ABBREVIATIONS

IN THE OUTLINE OF THE VARIOUS DISEASES, AND CONDITIONS, SET FORTH IN THE FOLLOWING PAGES OF THE ELECTRO-THERAPEUTIC INDEX, THE FOLLOWING ABBREVIATIONS WILL BE USED:

Abd.—Abdomen.
Ana.—Anaphoresis.
Alt.—Alternated mode.
Cat.—Cataphoresis.
Con.—Constant mode.
C. G.—Central galvanization.
B.W.G.—Birmingham wire gauge.
Diag.—Diagonal.
Elect.—Electrode.
E. O. D.—Every other day.
E. M. F.—Electro-motive force.
F.—Faradic mode.
Ful.—Fulguration.
G.—Galvanic mode.
G. F.—General faradization.
G. G.—General galvanization.
H. F.—High frequency mode.
Int.—Interrupted mode.
Int.-ut.—Intra-uterine.
Lab.—Labile, or moving application.
Long.—Longitudinal.
Ma.—Milliampere.
Mag. Wave.—Magnetic waves.
N. P.—Negative pole.
P. P.—Positive pole.
P. P. P.—Positive pole for pain.
Prim.—Primary faradic mode.
P. R. N.—*Pro re nata.* According to the nature of the case. Dosage and frequency to be governed by the conditions, circumstances and effects produced.
S.—Static mode.
Sec.—Secondary faradic mode.
Sin.—Sinusoidal mode.
S. Ind.—Static induced mode.
S. Ins.—Static insulation.
S. S.—Static sparks.
Stab.—Stabile, or stationary application.
Trans.—Transverse.
Vac.—Vacuum.
Vag.—Vaginal application.
Vib.—Vibration.
+ Plus or positive pole.
— Minus or negative pole.

ELECTRO-THERAPEUTIC INDEX

N. B.—In the Index items, the figures (in parentheses) refer to the pages following.

SEE KEY OPPOSITE

ABCESS, to abort

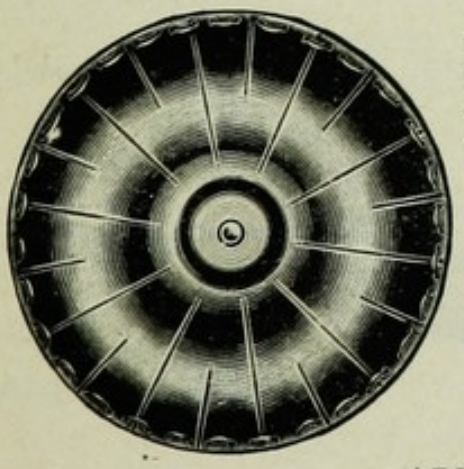
G. con., + at lesion, — distant, 15-20 ma., 10 min., daily. Use Bennett phoric, under +, with witch hazel, adrenalin, cocaine or other vaso-motor constrictor, — distant. Copper needle, + at lesion, — distant, 2-6 ma., 5 min., daily. H. f.-violet vac. surface elect., + to lesion, — grounded. Violet Minin, or helios light bath, over lesion, 30 min., daily. S. jet, + locally. H. f., mild sparks.

Abcess, old, open, to heal (See Ulcer)

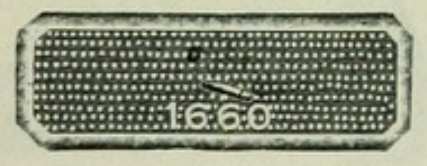
Abcess, mammary, threatened (See Abcess, to abort)

G. con., + at gland, clay pad, — on back, 10-20 ma., 15-25 min., daily.

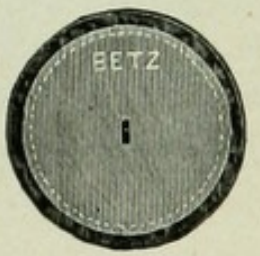
Abcess, Tubercular (See Abcess, to abort)



Spongio Piline, composed of pure sponge and felt. Holds moisture longer than sponge or any other material used for this purpose.



Dispersive, block tin back perforated;
4x6 6x8 8x12



Hayes', 8½ inches with flexible block tin back.

ABDOMINAL ELECTRODES

Abdominal Pains (See Pain)

"Find out the cause," etc., and apply P. P. P., p. r. n.

Abortion, Habitual (See Displacements, Fibroids, Metritis, Leucorrhœa, Prolapsus, Sub-Involution)

Give uterus a long rest from gestation, and institute a prolonged and regular course of tonic local intra- and extra-uterine treatment, to relieve any organic or functional derangement, with such applications as are indicated, strength and frequency, p. r. n.

Abortion, Threatened, to prevent

F. Sec., (long fine coil, not less than 3000 ft.), from sacrum to feet, very mild, 10-20 min. G. con., + abd., or sacrum, (Bennett disc), — at feet, 10-30 ma., 10-20 min., p. r. n.

Acne

G. con., + to point, ana., (Bennett phoric elect.), with cocaine, or bi-chloride sol., adrenalin or hammemelis, — distant; or potass. iod., under —, 5 ma., 10 min., daily. S. s. Violet light. G. f. and c. g. X-ray, soft tube, short exposure, e. o. d., p. r. n. H. f. body elect. Ful. Many treatments required.

Actinomycosis

X-ray soft tube, short exposure, often, p. r. n. 8 in., 10 min., e. o. d. H. f., e. o. d., body elect. half inch spark. Ful. short spark.

Acute Diseases, Sequelæ (See Sequelæ)

Acute Neuritis (See Neuralgia)

Adenitis, Cervical (See Glands, Enlarged; Tuberculous Glands)

Adhesions, Pelvic

G. con., electric massage, with hand or roller, + over abd., — in vag., 10-30 min., e. o. d. Sin., same way. H. f. body and vag. elect. 10 min., e. o. d.

Afterpains, to check post-partum hemorrhage

F. sec., (short coarse coil), or g. alt., or sin., from int.- ut., to abd., (Bennett disc), swelling current.



Handle Sponge Electrode.

Afterpains

F. sec., (long fine coil), from back to abd., or g. con., + abd., Bennett disc, — back, 10-20 ma., 15-30 min.

Agitans, Paralysis (See Paralysis)

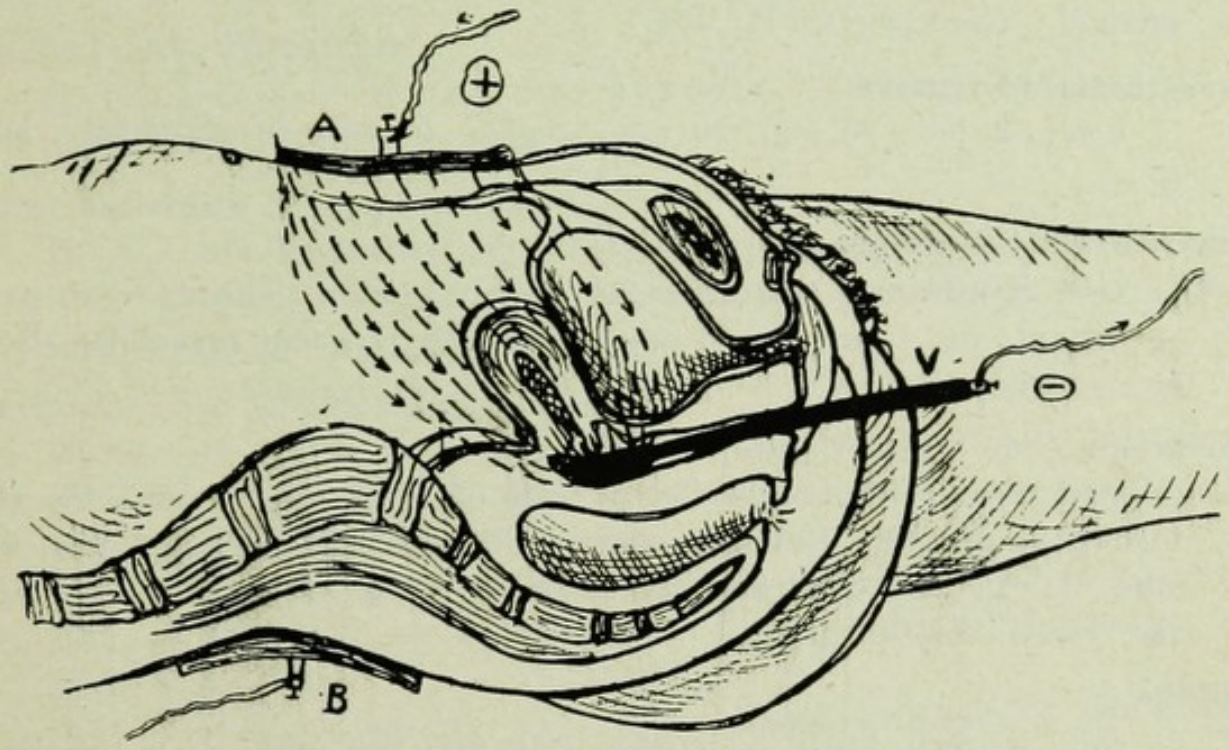
Albuminuria (See Bright's Disease)

Alcoholism

Electro-vapor baths. Electric light baths. Violet light baths. H. f. body elect. to spine, short sparks.

Alopecia

G. con., lab., — scalp, 5 ma., 10 min., e. o. d. S. shower, to head, —, 15 min., daily. X-ray, soft tube, 10 in. 5 min., e. o. d. H. f. body elect., short sparks.



Abdomino-Vaginal Treatment.

Amenorrhœa

G. con., — sacrum or abd., (Bennett disc), + feet, e. o. d. or g. con., — int.-ut., or vag., + back or abd., (See cut), 25 ma., 20 min., e. o. d. F. prim., same way, or sin., same way, or f. Prim., bipolar int-ut. G. f., and c. g., e. o. d. Bidet light bath. H. f. vag. elect., body elect. to spine, short sparks, daily 10 min. Bipolar, h. f. abd.-sac., 15 min., e. o. d.

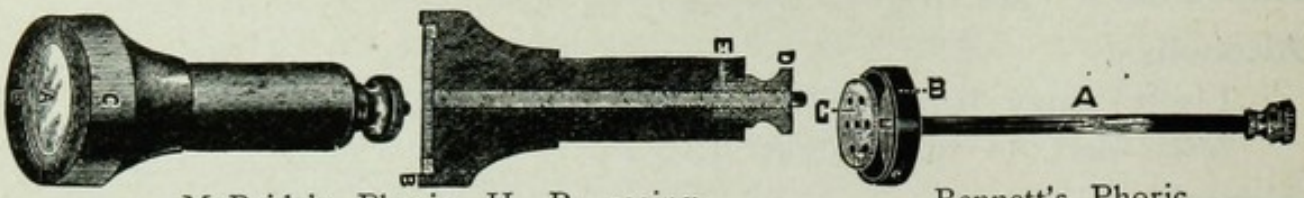
Anal Diseases (See Rectal Diseases)

Analgesia, to produce

G. con., + to part, — distant, 5-20 ma., 12-20 min. Sin., locally. F. sec., (long fine coil), high tension. Violet light. Bennett magnetone. Bachelet wave generator. Helios light.

Anæmia, Cerebral (See Brain)

Anæmia, General (See Debility, General, Marasmus)



McBride's Phoric, H. R. casing. Bennett's Phoric.

Anæsthesia, Local, to produce

G. con., + to part, ana., 10 ma., 10 min., — distant.Bennett phoric, Violet light, 30 min. F. sec., (long fine coil). S. vib., Bennett method. (See pages 164, 165.)

Anæsthesia, to remove

G. con., — lab., 10 ma., 20 min., daily. F. wire brush locally, lab., S. s.

Anchylosis (See Synovitis)

G. con., if inflamed, + to part, — distant; if not painful, — to part, + distant; or + and — on opp. sides with frequent reversals. Bennett magnetone.

Aneurism (See Hemorrhoids)

G. puncture, platinum needle, or coil of wire, + 20 ma., till clot forms, — distant. Reverse polarity till needles loosen, 5-6 ma., 2-3 min. H. f., auto-condensation, 10 min., daily. Do *not* use surface, vac. elect. over aneurism.

Angina

G. con., + over heart, — nucha, 5-10 ma., 2-5 min. C. g. S. ins., Helios violet light, 20 min.

Ante-Flexion, Uterine (See Displacements)

Ante-Version, Uterine (See Displacements)

Anthrax (See Carbuncle)

Anus, Fissure of (See Ulcer)

G. con., + copper elect., lab., in fissure, — stab., near, 5 ma., 5 min., e. o. d. H. f. rectal elect., 10 min., daily.

Aphasia (See Paralysis)

If acute: G. con., + over Brocha's center, — behind opp. ear, 3-5 ma., 5 min., daily. S. spray and shower, 10 min., daily. If chronic: G. con., + at nucha, — over Brocha's center, large elect., both stab.; then — at sub-aural region, + nucha, 3-6-10 ma., 3-6-10 min., daily. Bennett head magnetone, 10-40 min., daily.

Aphonia (See Paralysis)

F. prim.; or g. con.; or g. int., — to throat, external; or s. ind. Electric massage with hand, + in hand of patient, or down spine, lab. S. ins., 15 min., daily.

Apoplexy (See Arterio-Sclerosis)

G. con., to brain, — lab., 1-3 ma., 10 min., daily, (only after 3rd wk). *Do not use static.* F. sec., (long fine coil), nucha, and spine, to affected muscles, or over motor points. Mild lab. massage, 10 min., daily. C. g., and g. f. H. f. auto-condensation, 5-15 min., daily or e. o. d. to lower blood pressure.

Appendicitis, Threatened

G. con., + Bennett disc, over appendix, — back, 10-15 ma., 30-60 min., daily, or oftener, p. r. n.

Arteriosclerosis (See Apoplexy)

H. f., auto-conduction, or auto-condensation, 10-20 min., daily or e. o. d. H. f., lowers blood pressure, static insulation raises pressure, so do not use static.

Arthritis (See Rheumatic Arthritis)

Acute: G. con., + to joint, 5-15 ma., 20 min., daily. G. massage with hand, — feet. S. spray. S. vib., + to joint. Violet light, 15-30 min., daily.

Chronic: If part can be immersed in a water bath, of strong lithia sol., — g. con., to elect, in bath, + distant, outside bath, 15-30 ma., 15-20 min., daily.

If helpless apply portable light bath, general, or local, 20 min., daily. Bennett magnetone. Schnee baths.

Arthritis Deformans (See Arthritis)

If not painful: G. con., cat., potass. iod., on — to joints, with Bennett phoric, 20 ma., 20 min., daily. S. s., mild local. H. f., prolonged treatments often do much good. Schnee baths.

Articular Inflammation (See Arthritis, Rheumatism)

Artificial Respiration (See Respiration)

Aspermatism (See Sterility)

Asphyxia (See Respiration)

F. prim., or sec., (short coarse coil), from left side neck, stab., to epigastrium, lab., strong dose, int., 15-20 times per min., to keep up artificial respiration, p. r. n.

Asthenopia (See Eye Diseases)

G. con., to eye cup, — nucha, or temple, 2-3 ma., 5 min., daily. F.

sec., mild, (long fine coil), same way. S. ins., + spray, to eye, daily, 10 min. C. g. H. f., to spine, neck, apply to back rapidly 3-5 min., through several layes of cloth.

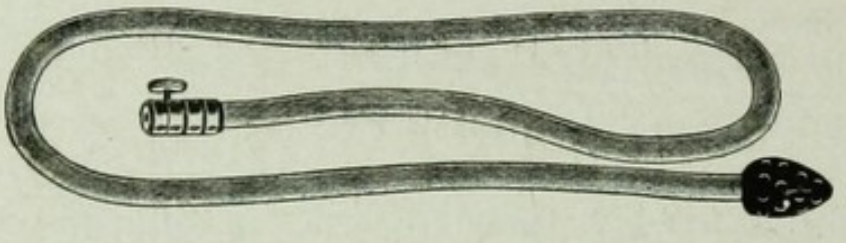
Asthma (See Bronchitis)

G. con., + behind left ear, — epigastrium, 10 ma., 10 min., daily. G. con., to spine, + nucha, — sacrum, stab., 15 ma., 20 min., daily. C. g. Sin., stab., to sympathetic in neck. S. ins., 20 min., daily. Violet light on neck and chest, 20 min., daily. Ozol inhalations, 20-40 min., daily. H. f., auto-condensation 10 min., daily, body elect. spine and chest.

Astraphobia

Calls for a course of electrification as a general tonic. G. f., and c. g. Vapor baths. S. ins. S. cage. Magnetization, bath and waves.

Ataxia, Locomotor (See Locomotor Ataxia)



Atony of Stomach (See Dyspepsia)

F. sec., (coarse coil), deglutable elect. in stomach, (See cut), other pole, lab., over epigastrium, 10-15 min., daily. C. g. F., front to back. H. f., body vac. elect., 5 min., auto-condensation 10 min., daily. Bipolar method, stomach-back, 10 min., daily.

Atrophic Rhinitis (See Ozena)

Atrophy and Non-Development (See Bust Development)

Bust and penil developer elect., used with g. con., int.; or alt.; or sin.; or f. sec., or prim., moderate vac., and mild doses, e. o. d. (See Lesson No. 20, page 5).

Atrophy, Muscular, Simple

G. con., — lab., to parts, + distant, 10-20 ma., 15-20 min., daily. F. sec., (coarse coil), electric massage to wasted muscles.

Atrophy, Optic (See Eye Diseases)

Atrophy, Progressive Muscular

F. sec., (coarse coil), local massage, large electrodes. G. con., — lab., to part, + distant. G. con., to spine. S. s., or roller. Duration and frequency, p. r. n.

BACKACHE (See Pain)

Baldness (See Alopecia)

Barber's Itch (See Sycosis)

Birth Marks (See Nævus)

Bladder, Irritable (See Cystitis)

F. sec., (long fine coil), from bladder, or sac., to abd. G. con., + abd., or sac., — feet. G. con., + to soluble bladder elect., — back, or abd., Bennett disc, 15 ma., 15 min., daily. Sin., from back to abd., mild.

In girls and children, g. con., + over pubes, — back, 5-10 ma., 10-15 min., daily.

Blastomycosis (See Actinomycosis)

Blemishes (See Nævus, Hairs, Moles)

Blepharitis (See Eye Diseases)

Blindness (See Eye Diseases)

Boils, Open (See Ulcer)

G. con., + copper tip, to lesion, — distant, 5-10 ma., 5-10 min., daily.

Boils, to abort (See Abcess)

Brachial Neuritis (See Neuralgia, Pain)

G. con., + to part, — distant, 5-15 ma., 10-20 min., daily. S spray, to part. Violet light bath, and helios lamp light, 20 min., daily. H. f., body elect. 10-15 min., daily.

Brain Fag (See Neurasthenia)

Brain Troubles (See Head Pains, Insanity)

Various brain conditions should be met with the indicated g. con., polarity, thus:

ANÆMIA: G. con., — lab., to forehead, + nucha, stab., 2-4 ma., 2-6 min., daily.

HYPERÆMIA: Just the reverse polarities.

NEURASTHENIA: G. con., long., trans., or diag, p. r. n., with g. f., and c. g., weak modes, brief sittings, daily. S. crown, and Bennett head magnetone, 15 min., daily. Ozol inhalations, 20-40 min., daily. Magnetic wave bath.

HEMORRHAGE AND SOFTENING: No treatment under 3 weeks, or till all active inflammation subsides.

If painful: G. con., + to part, — distant, long., trans., or diag., p. r. n., according to the symptoms, and location of the clot. G. con.,

+ to relieve pain, (See Pain), and check hemorrhage, and to contract and harden the tissues.

If no pain or hemiplegia: G. con., — over lesion, to dilate and cause absorption of extravasation, and relieve the pressure, 2-6 ma., 2-6 min., daily. Bennett head magnetone, 5-15 min., daily, to influence tissue metabolism.

Breast, Cancer (See Carcinoma)

Breasts, to develop (See Bust Development)

Bright's Disease

S. ins., 30 min., daily, + to feet, bare, or to crown, — wet sponge, on bare skin over kidneys; surging, or s. vib., Bennett method, 30 min., daily. S. shower, 5 min., daily. S. s., spine, mild, daily. S. cage, Bennett magnetone. Ozol inhalations, 20-40 min., daily. H. f. auto-condensation, body elect. 15 min., daily. Magnetic wave bath.

Bronchitis (See Asthma, Consumption)

G. con., to pneumogastric nerve, + in fossa under left ear, — top sternum, 5 ma., 10 min., daily. Ozol inhalations, 20-40 min., daily.

Bulbar Paralysis (See Paralysis, Bulbar)

Bunions (See Chilblains)

S. s., and roller, short, 10 min., daily. G. con., Bennett phoric, cocaine, + to joint, — distant, 5-15 ma., 5-15 min., daily. S. spray, local. Violet light, 20 min., daily. Bennett magnetone.

Burns

G. con., + to lesion, 5 ma., 10 min., daily. Bennett phoric, ana., Violet, 20 min., daily.

Burns, X-Ray, to prevent

Follow every X-radiation with the same or longer exposure to the Minin. violet light.

Bust Development

Elect.-vac.-massage, local. Bell over breast. G. con., — to bell, + on abd., Bennett disc, or + in vag., carbon elect., 5-10 ma., 10-15 min., daily, or e. o. d. Sin., or f. sec., from breast to breast, or from one breast to opp. hand. Mild dose, and moderate vac., not to be painful. Elect. hand, lab., stroke from periphery to nipple. (See cut on page 31.) H. f., body vac. elect. over bust, 10 min., daily.

CALLUSES (See Corns)

Canieties (See Gray Hair)

Cancer (See Carcinoma)

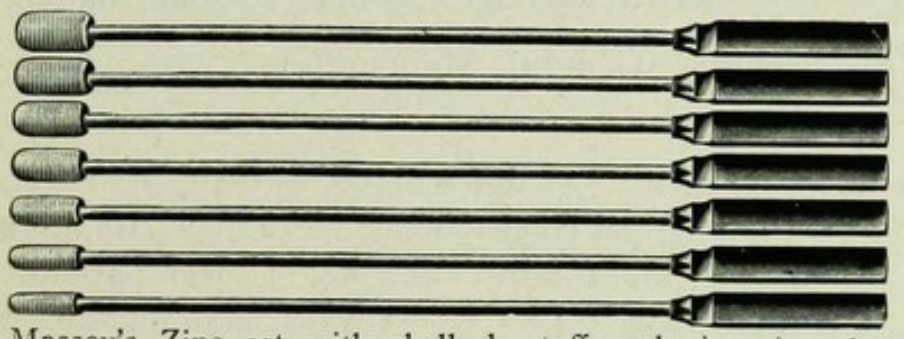
Carbuncle, to abort (See Abcess, Boils, Ulcer)

G. con., + to part, — distant, 10-20 ma., 10 min., daily. H. f., body elect.

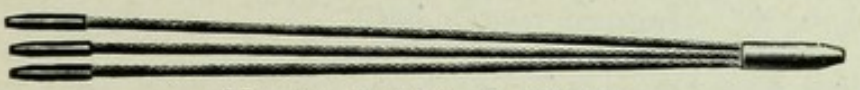
SUPPURATIVE: G. con., + to copper needle or elect, in lesion, — distant, 5 ma., 5-10 min. X-ray, soft tube, 5 min., every 3 da. If open, treat same as an ulcer. H. f. body vac. elect., local daily for pain.

Carcimona (See Lupus)

G. con., local anæsthesia, by injection, or Bennett phoric, + to part. G con., — with needles, in Bennett needle holder, in base of growth, (if small), 10-25 ma., 10 min., withdraw, and re-insert needles at right angles and repeat. One seance usually enough. If large, use a number of separate long needles (see cut page 172), inserted at different angles. In very large growths, both poles may be inserted. with platinum or gold + needles. General anæsthesia, with Massey gold, zinc-mercury elects., (see lesson No. 29), on + pole in growth, with very strong doses, 500-1500 ma., 30-90 min. Parsons method: G, alt., 300-400 ma. X-ray often used to advantage, soft tube, 5-10 in. distant, 5-20 min., daily or e. o. d. Protect surrounding healthy parts with Allen shield. Follow every radiation with a bath in the violet light. Ful. strong sparks under anæsthesia.



Massey's Zinc set with shellack staff and zinc tips, for Phoresis.



Needle Holder, 3 strands.

Caruncle (See Warts)

Caratact (See Eye Diseases)

Catarrh

Nasal: G. con., + copper or zinc-mercury elect., to nose, lab., 2-10 ma., 5 min., e. o. d. H. f., nasal vac. elect., + to nose, 5 min., daily.

Uterine. (See Leucorrhœa).

Summer. (See Fever, Hay).

Central Galvanization (See Page 189)

Cephalalgia (See Headaches)

Cerebral Affections (See Brain Troubles)

Anæmia: (See Brain Troubles)
Congestion: (See Brain Troubles)
Hyperæmia: (See Brain Troubles)

Cervical Erosions (See Erosions, Ulcers)

Cervical Lacerations (See Erosions, Scars)

Chalazia (See Eye Diseases, Hair, Acne)

Chancroids

G. con., copper or zinc elect., lab., + to part, — distant, 5 ma., 5 min., daily. H. f., short spark. Ful.

Chilblains

G. con., + lab., to part. S. spray, or mild s. s., 5 min., daily, G. con., + copper elect., to part, 10 ma., 10 min., e. o. d. Violet light, Bennett magnetone. H. f., vac.-elect. half inch spark, 10 min., daily or e. o. d.

Chloasma (See Liver Spots)

G. con., — lab., electric massage, 10 ma., 10 min., daily.

Chlorosis (See Debility, General, Marasmus)

Chorea

G. con., + to forehead, and down spine, — feet, 3-10 ma., 5-10 min., daily. G. con., spine to epigastrium, 10-15 ma., 10 min., daily. S. shower. S. ins., 15 min., daily. G. con., + over parietals, — hands, 3-5 ma., 3-5 min., daily. (N. B.—Always examine for, and correct, genital abnormalities). H. f., body elect., spine, auto-condensation, 15 min., e. o. d. Magnetic wave bath.

Choroiditis (See Eye Diseases)

Cicatrix

White scars: G. con., — lab., 5-10 min., 5-10 ma., daily. H. f., sparks.

Vascular: G. con., + Bennett phoric, with witch hazel, stab., 5-10 ma., 10 min., daily. Ful. H. f. sparks.

Very vascular: G. con., — needles in Bennett needle holder, under surface of skin, 5 ma., 10 min., weekly. Ful. H. f. sparks.

Coccygodynia (See Neuralgia)

G. con., + to coccyx, Bennett phoric, — distant, 5-10 ma., 10 min., daily. S. vib., Bennett method, + coccyx, — feet, 5-15 ma., daily.

Coldness of Extremities

G. con., lab., — to parts, + distant, 5-10 ma., 10 min., daily. F. sec., lab., (coarse coil), to parts. G. f. S. s., to parts. S. roller, same, 15 min., daily. S. vib., Bennett, method, — feet, 10 min., daily. H. f., body elect., spine and feet, 15 min., e. o. d.

Colitis

H. f., auto-condensation, 10 min., e. o. d., body elect. over colon, daily.

Colon, Scales in the (See Constipation)

Comedones

G. con., — needle in part, 3-5 ma., 15-30 seconds. Follow with g. con., + Bennett phoric, with witch hazel or antiseptics, lab., 5 ma., 5 min., daily.

Condyloma (See Warts)

Conjunctivitis (See Eye Diseases)

Constipation

Either mode, + abd., lab., hand, sponge or roller, — back, stab. In chronic cases, use — rectal elect. G. alt., or int., 2-10 ma., 15 min., daily. S. ind., 1-2 in. spark, abd., and back. S. vib., + back, — abd., Bennett method, frequently causes prompt stool. G. f., and c. g., daily. H. f., abdom., 15 min., daily, rectal vac., elect. auto-condensations. Body magnetone, magnetic wave bath.

Consumption, Pulmonary

S. ins., 15 min., daily. H. f., diasolenic zone, or electric cage, 20 min., daily. H. f., surface vac. elect., over lungs. Ozol inhalations, 30-40 min., daily. Helios violet light, bath, 35 min., daily. Electric massage over abd. (See Massage). C. g., and g. f. Magnetic wave bath.

Consumption, Various (See Tuberculosis)

Contractions

F. con., — lab., to part, + distant, 5-15 ma., 10-15 min., daily. Dupuytren's contraction of the palmar fascia, has been relaxed this way. H. f., sparks to part, 15 min., e. o. d.

Convalescence, Delayed (See Marasmus)

Corns

G. con., + to corn, or local ana., with Bennett phoric, with cocaine, 5 ma., 10 min., daily. Mild s. s., or local s., + spray, or wood ball, 5 min., daily. H. f., sharp spark. Ful.

Corneal Opacity (See Eye Diseases)

Corneal Ulcer (See Eye Diseases)

Coughs (See Asthma, Bronchitis, Consumption)

Cramp, Writers' (See Writers' Cramp)

Cystitis (See Bladder, Irritable)

G. con., + copper soluble hydro-elect., bladder tip No. 6, — abd., Bennett disc, 5-15 ma., 10-25 min., daily. Sin., abd., back, mild, 15 min., daily. H. f., rectal elect., 10 min., daily.

DANDRUFF (See Seborrhœa)

Deafness

When due to paralysis or chronic thickening of the tympanum: G. con., — hydro-elect., in external ear, + opp., on mastoid, 1-5 ma., 3-5 min., daily.

If nervous: G. con., + in front of ear, over tragus, — distant, 3-5 ma., 5-10 min., daily.

If there be tinnitus: H. f. insulated glass vac. elect., in external ear, mild treatments, daily. H. f., surface elect., to mastoid process, mild, often.

Catarrhal: G. con., — over spine, + solar plexus, 5 ma., 10 min., daily.

Electro-vapor bath.

Telephone ear, neurotic: S. spray, over ear, 10 min., daily.

Debility, General (See Marasmus)

G. f., sec., med. strength, 15 min. C. g., 10 min., alt., e. o. d. S. ins., daily, 15 min. Electro-vapor baths, p. r. n. Magnetization. H. f., auto-condensation, 15 min., daily. Magnetic wave bath.

Degeneration, Reaction of (See Paralysis)

See formula in section two.

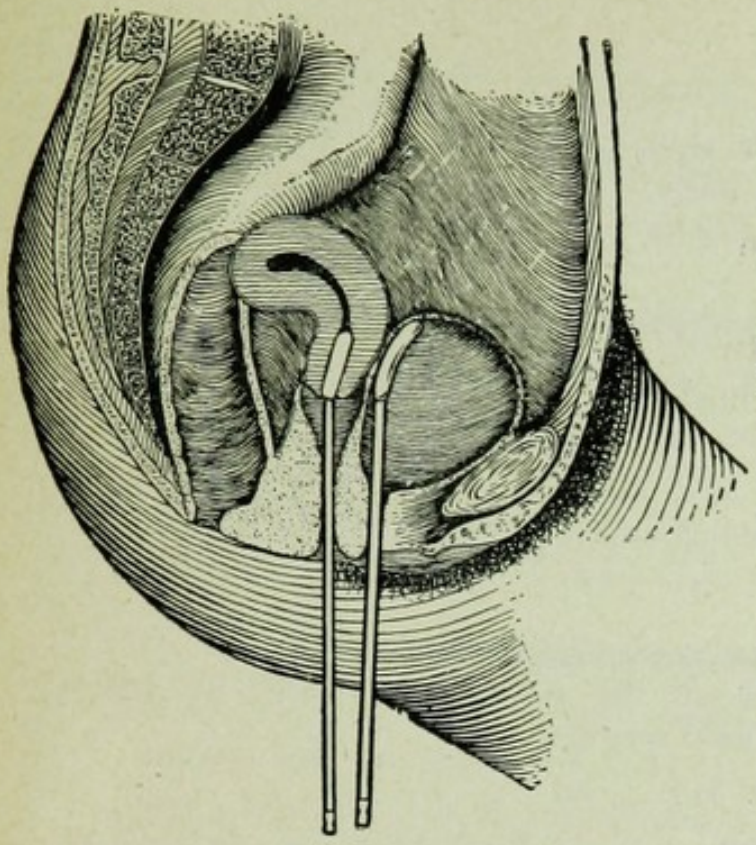
Delayed Convalescence (See Marasmus)

Depilation (See Hairs, Superfluous)

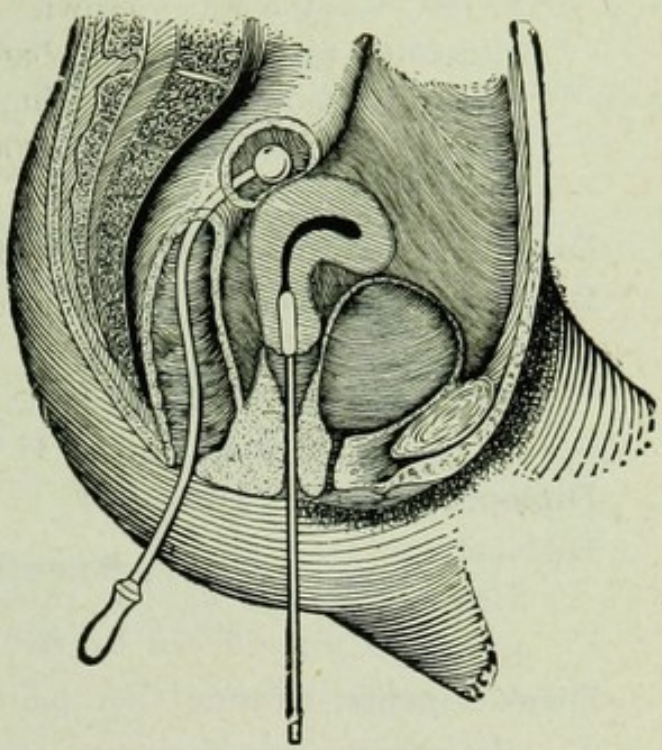
Dermatitis, X-Ray

Violet light, with Russian or helios lamp, p. r. n., 10-30 min., 30-40 in. away, daily.

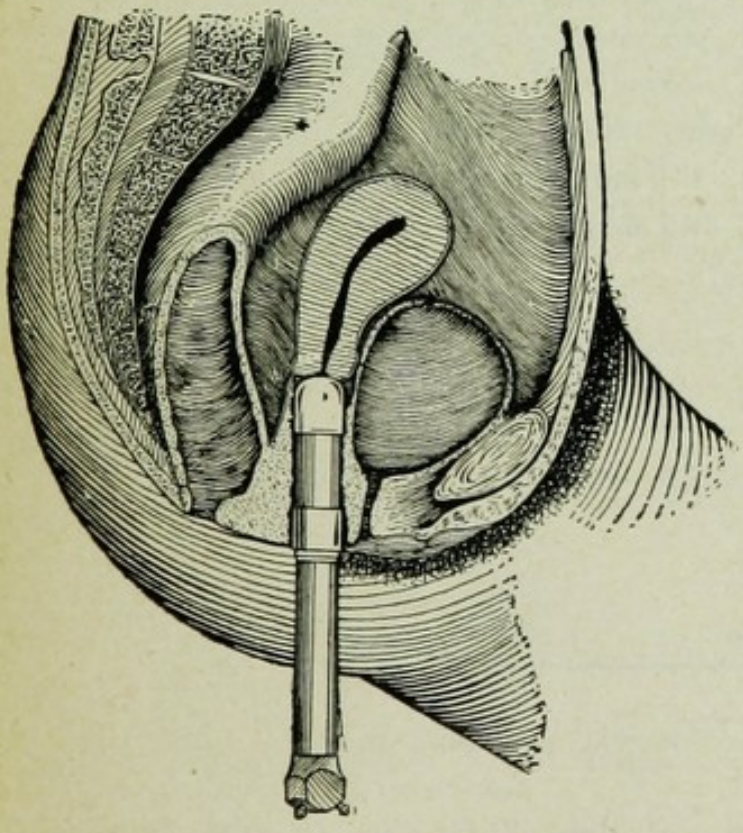
Development, Bust (See Atrophy, Bust Development)



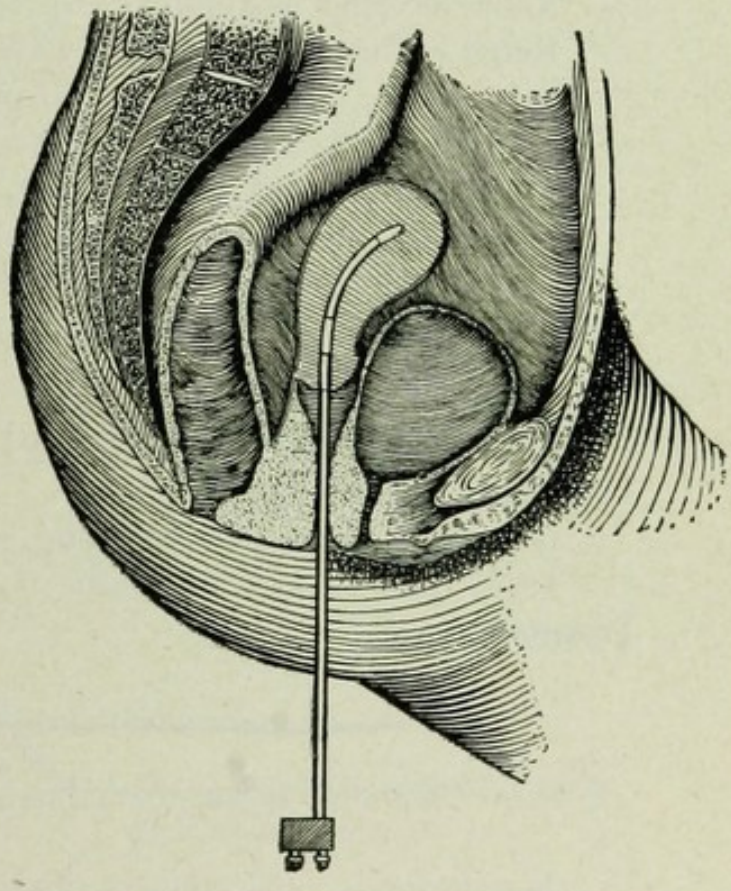
Retro-flexion. Utero-Vesical Faradization.



Ante-flexion. Utero-Rectal Faradization.



Bi-polar Vaginal Faradization.



Bi-polar Intra-Uterine Faradization.

Diabetes (See Bright's Disease)

S. ins., + at feet, — crown. S. surge, alt., + feet, — over kidneys, bifurcated sponge elect, to bare skin, 25 min., daily. Bennett method of s. vib., same way, 25 min., daily. S. s., to entire spine. G. f., & c. g. H. f., auto-condensation daily, 10-20 min., p. r. n. Magnetic wave bath.

Diagnosis, Electro- (See section two)

Diaphragm, Spasm of (See Hiccough)

Diarrhœa (See Constipation)

G. f. G. con., abd., to back, lab., roller or hand, + abd., — back, or rectum, 20 min., daily. H. f., body elect., spine.

Diplopia (See Eye Diseases)

Dislocations

Detected by the electric probe, or the X-ray, fluoroscope, or radiograph. Pain relieved by Bennett magnetone.

Displacements, Uterine (See page 31)

Prolapsus: (See Prolapsus Uteri).

Ante-flexion:
Ante-version:
Retro-flexion:
Retro-version:
} For the various flexions and versions apply bi-polar f., either int.-ut., or ut.-vesical, or ut.-rectal, so as to stimulate to contraction, the weakened muscles in the flexed walls, or in the ligaments, if verted, p. r. n. G. int., or alt., from int-ut., to abd., or sacrum, with Bennett disc. S. vib., Bennett method, excellent. Sin., is splendid. All treatments should be mild, (g. con., 20-40 ma.,) and often, over a long time, till uterus is normal. "Find out he cause." Select the modes indicated to counteract it, and treat persistently, p. r. n.

Distichiasis (See Hairs, Superfluous)

Dizziness (See Brain Troubles)

Drug Addictions (See Alcoholism)

Dysentery (See Diarrhœa)

G. con., + hydro-elect., rectal soluble, in rectum, with water, — feet, 10-15 ma., 10-15 min., daily.

Dysmenorrhœa

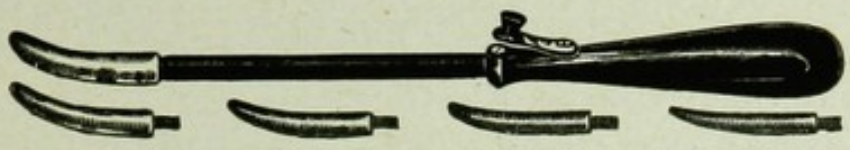


Massey's shellac Intra-Uterine, flexible, platinum, spiral.

Membranous: G. con., — int.-ut., + abd., 20-50 ma., 15 min., twice a wk., between periods. F. sec., (long fine coil), vag., abd., e. o. d.

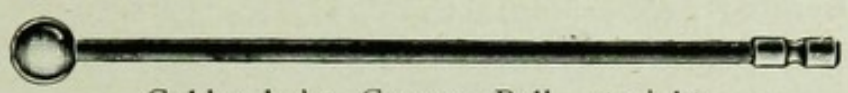
Obstructive: (See Stenosis, Stricture). S. ins., and breeze. S. s., to spine, daily.

Virginal: G. con., + abd., and sacrum, — feet, 25 ma., 30 min., daily. G. con., carbon or copper elect., cotton covered, + vag., —



Kieth's Galvanic Uterine Dilating set, with assorted dilators.

feet, abd., or sacrum, with Bennett disc. S. ins. S. spray, to back 15 min., daily. Bidet violet light chair, local, 30 min., daily. Body



Goldspohn's, Copper Ball, straight.

magnetone, 30 min., daily. H. f., body elect. or vag. auto-condensation, 15 min., e. o. d. Magnetic wave bath.

Dyspepsia, Atonic

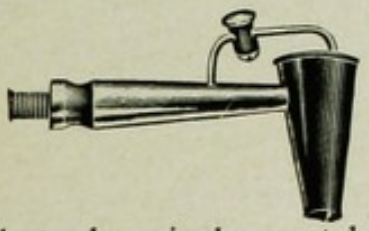
G. con., to pneumogastric, thus: + to fossa under left ear, — top sternum, 5 ma., 10 min., daily. S. ins., and shower, daily. C. g., and g. f., sec., (long fine coil), 10 min., daily. F. stomach elect., swallowed, to pad over epigastrium, (fine coil), 5 min., daily, or front to back. H. f., body elect. over stomach, auto-condensation, 15 min., daily.

Dyspnœa

G. con., + in fossa under left ear, — top sternum, 5 ma., 10 min., G. con., + to sympathetic nerves in neck, — at 7th cervical vertebra, 2-5 ma., 10 min., daily. G. con., to spine. C. g., and g. f. S. ins., 15 min., daily. Ozol inhalations, 20-40 min., daily. Auto-condensation 15 min., daily. Magnetic wave bath.

EAR-ACHE (See Deafness)

G. con., + in ear on wet cotton, or hydro-elect., 3-5 ma., 2-4 min.,



Ear Electrode, single, metal contact through speculum.



Eustachian Electrode.

repeat, p. r. n. S. spray, over ear, 5 min. Violet light, over ear, 15 min. H. f., ear elect., body elect., around ear, 10 min., p. r. n.

Ectopic Pregnancy (See Gestation Ectopic)

Eczema (See Lupus, Carcinoma)

G. con., + to parts. C. g. S. s. and s. spray, 5 min., daily. Violet light, 15-30 min., daily. X-ray, soft tube, 10 in. away, 5-10 min., daily, or e. o. d., p. r. n. H. f., body elect. 10 min., daily, auto-condensation.

Electric Hand (See Massage, Electric)

Electric Injections (See Constipation, Impaction)

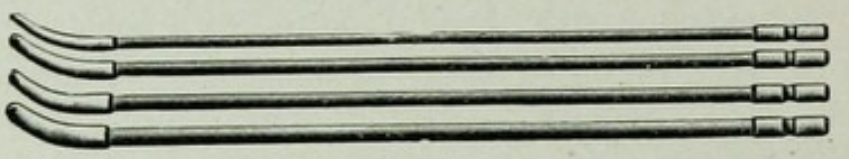
Electro-Diagnosis (See section two)

Elephantiasis

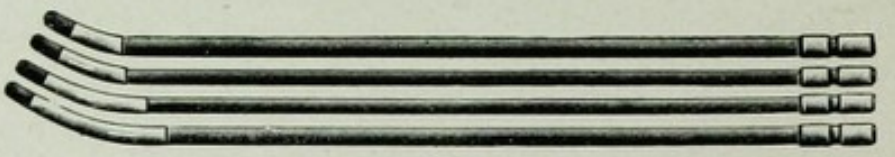
X-ray, med. tube, 10 in. e. o. d.

Emissions, Seminal (See Neurasthenia)

G. f., and c. g. Vapor baths. S., ins. S. s., spine. If excessive: G. con., urethral elect., (See Stricture), — internally, + distant, 2-5 ma., 2-5 min., daily. S. vib., Bennett method, + perineum, — nucha, mild vib., 5-15 min., daily. Violet helios light to spine. Bidet local bath, 20 min., daily. Ozol inhalations, 20-40 min., daily.



Goldspohn's Tin, or Copper Tip, 4 sizes.



Neiswanger's Tin, or Copper Tip, 4 sizes.

INTRA-UTERINE ELECTRODES

Endometritis (See Metritis, Leucorrhœa)

G. con., — int-ut., + abd., 10-60 ma., 10-30 min., once or twice a wk., between periods.

Hemorrhagic: (See Hemorrhage). G. con., + int.-ut., copper tip, — abd., Bennett disc, 10-15 ma., 5-10 min., e. o. d. Reverse poles a few min., to loosen elect.

Virginal: (See Dysmenorrhœa, Virginal.)

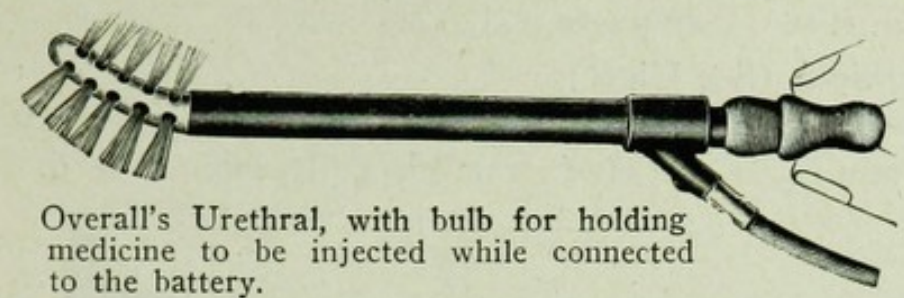
Enlarged Lympathics (See Glands, Enlarged, Goiter)

Enlarged Prostate

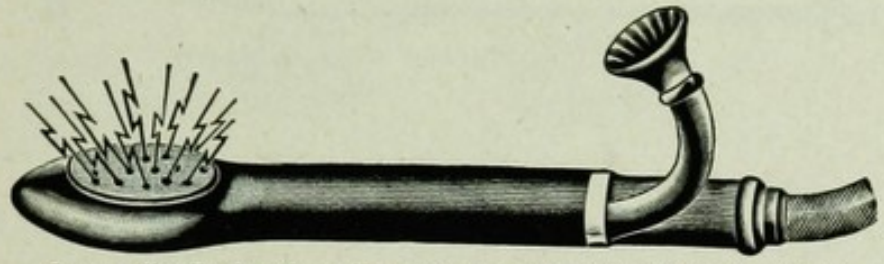
G. con., — prostatic phoric, or No. 6 soluble tip, hydro-elect., with potass. iod., in — tube, + back, 2-8 ma., 3-10 min., e. o. d., or reverse poles to get local interstitial copper ana.

Epididymitis (See Orchitis)

Epilation (See Hairs, Superfluous)



Overall's Urethral, with bulb for holding medicine to be injected while connected to the battery.



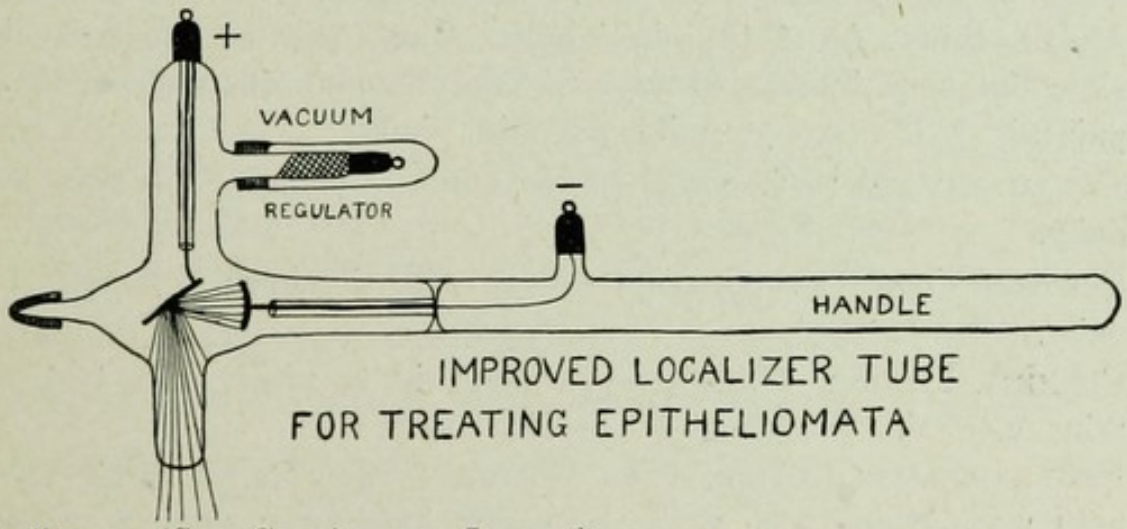
Overall's Irrigating Prostatic with tube for medicine.

Epilepsy (See Hystero-Epilepsy)

G. con., + forehead, — nucha, 3 ma., 5 min., daily. G. con., + lab., spine, — feet, 15 ma., 10 min., daily. C. g., and g. f. S. crown, 20 min., daily. Violet light, 15 min., daily. Electric wave bath.

Epistaxis

G. con., + copper elect., — nucha, 3-10 ma., 5-10 min., repeat p. r. n. Reverse poles at finish for 1-3 min., to loosen tip. G. con., sponge elect., or Bennett phoric, + over nose, — nucha, 5 ma., 10 min.



IMPROVED LOCALIZER TUBE FOR TREATING EPITHELIOMATA

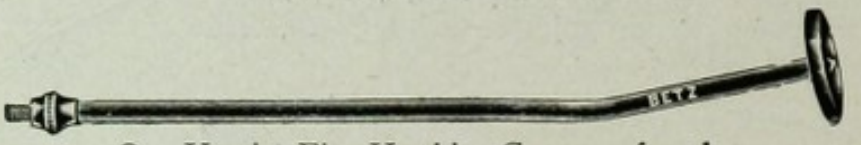
Epithelioma (See Carcinoma, Lupus)

G. con., — in Bennett needle holder, under base, + distant, 5-20 ma., 10 min., remove and reinsert needles at right angles to 1st insertion, and repeat. Only one operation needed. Use local anæsthesia first,

with injections, or with Bennett phoric, 5-10 ma., 10 min. Dress with HgO_2, ungt, till growths drop off, then with ordinary antiseptics. X-ray with localizer tube pressed on growth, 10-30 min., daily or e. o. d., p. r. n. (See pages 171, 172)

Erosions, Cervical (See Ulcer)

G. con., + copper or zinc tip, lab., to os, — abd., Bennett disc, 5-20 ma., 10 min., e. o. d. H. f., vag. elect., 10 min., e. o. d.



Os Uteri, Fitz-Hugh's Copper faced.

Erysipelas

G. con., + Bennett phoric, with witch hazel, or antiseptics, — distant, 3-8 ma., 5-10 min., daily. Russian or helios violet light bath, 10-30 min., daily.

Erythema (See Hives)

Excoriations (See Erosions, Ulcers)

Exophthalmus (See Goiter)

Eye Diseases, Various (See Asthenopia, Diplopia)

BLEPHARITIS: H. f., vac. elect., to margins, 2-4 min., daily. Surface vac. elect., over closed eye.

CATARACT: G. con., sponge or eye cup, to eye, other pole to cheek. Turn on to 2-5 ma., 1-2 min., then off slowly, reverse poles, repeat several times, for 5-18 min., daily. Close with — on eye. Result slow but sure in soft forms. S. vib., Bennett method, — to eye if painful, + if not, very mild, 2-3 min., daily.

CONJUNCTIVITIS: G. con., + eye cup, — distant, 2-4 ma., 3 min., daily.

CORNEAL OPACITY: G. con., — eye cup, + cheek, 1-2 ma., 2 min., daily.

CORNEAL ULCER: G. con., + copper tip to ulcer, lab., ½-1 ma., 1 min., e. o. d. S. spray, +, 5 min., daily.

EXOPHTHALMIC GOITER, (SEE GOITER): G. con., + neck, — back, 5-10 ma., 20 min., e. o. d. S. spray, local over eye. S. crown, 15 min., daily. H. f., elect. hand, 5 min., daily.

FOREIGN BODIES (METAL): Use eye magnet.

GLAUCOMA: G. con., + cervical sympathetic, lab., whole length of neck, — at 7th cervical vertebra, 5-10 ma., 10-15 min., e. o. d., also

use same treatment as far cataract. H. f., electric hand, + locally, 5 min., daily. Auto-condensation, 15 min., daily.

IRITIS: G. con., + eye cup, — cheek, 2-5 ma., 5-10 min., e. o. d. S. spray, locally, 10 min., daily. H. f., electric hand, + locally, 5 min., daily.

NERVE ATROPHY: G. con., + nucha, — forehead and upper cervical ganglia, 5 ma., 5 min., daily. S. vib., Bennett method, locally, 5 min., daily.



Eye, double Electrode.

OPTIC ATROPHY: G. con., + nucha, — forehead or eye cup, alt., every minute, swelling app., close with — on eye (see Cataract), 2-5 ma., 10 min., daily. S. spray, locally 5 min., daily. S. vib., Bennett method, very mild, 5 min., daily. H. f., eye vac. elect., to lids, body vac. elect., to temples, 5 min., daily.

PTERYGIUM: G. con., platinum needle, + ½ ma., or eye cup, 2-5 ma., 15 min., e. o. d., — nucha, daily.

RETINO-CHOROIDITIS: (See Iritis.)

STRABISMUS: G. int., or f. prim., + to eye cup, — on temple, toward weaker muscles, 1-3 ma., 5-10 min., e. o. d. S. spray, 5 min., daily.

TRACHOMA: G. con., + copper tip, lab., to granulations, — in hand, (anesthaine), 3 ma., 2-3 min., wkly.; or — needle into each granule, + in hand, 2 ma., wkly. X-ray, to eyes, soft tube, 10-15 in. away, 5 min., e. o. d.

TRICHIASIS AND DISTICHIASIS: (See Hairs, Superfluous).

VITREOUS OPACITY: G. con., — eye cup, hydro.-elect., to closed lids + nucha, 2-4 ma., 5-10 min., daily. H. f., eye elect., 5 min., e. o. d.

FACE WRINKLES (See Wrinkles)

Facial Blemishes (See Nævus, Hairs, Moles, and Lesson No. 25)

Facial Paralysis (See Paralysis)

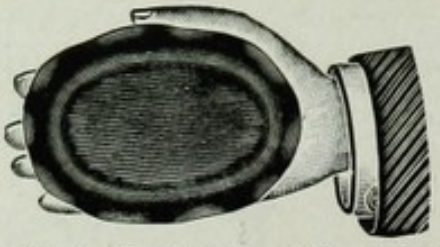
G. con., + lab., to affected muscles, — over exit of facial nerve, 3-10 ma., 5-10 min., daily. S. vib., Bennett method, — over affected area, + nucha, or distant, 5 min., daily.

Facial Spasm

G. con., + above or in front of ear, — nucha, 5 ma., 5 min., daily.

Faradization, General (See page 185)

F. sec., from coccyx, or feet, stab., to hand pad, all over body, lab., (See Electro-vapor baths).



Hand Pad Electrode, soft rubber back.

Fainting (See Brain Troubles)

Falling of the Womb (See Prolapsus, Displacements)

Favus

X-ray, soft tube, short exposure, often, carried to point of depilation and mild dermatitis. If extensive, go very slowly, follow with violet light, helios or Russian, 15 min., daily. S. crown, 15 min., daily. H. f., body elect., 10 min., daily.

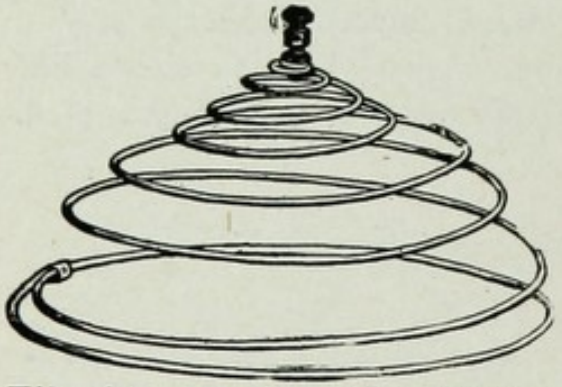
Fecal Impaction (See Impaction, Fecal)

Fever, Convalescence (See Sequelæ, Marasmus)

S. ins., s. shower, 20 min., daily. S. surge. G. f., and c. g., e. o. d., p. r. n.

Fever, Hay

G. con., + copper tip, to nose, lab., — hand or cheek, stab., 2-5 ma., 4-6 min., daily. S. ins., and ozol inhalations, 20-40 min., daily. H. f., vac., nasal elect., + in nares, 5 min., daily.



The simplest, most convenient and best electrode of the kind. It is light, cleanly, aseptic and strong. Adapted to any part of the body. Made of No. 14 spring steel wire, with a binding post at the apex; plated; weighs only 4 ounces; 8 inches in diameter.

THE BENNETT SPIRAL SPRING DISC ABDOMINAL ELECTRODE

Fibroids, Uterine (See Hemorrhage, Menorrhagia)

G. con., + abd., or sacrum, Bennett disc, — int.-ut., 20-200 ma., 10-30 min., wkly. If hemorrhagic, + int.-ut., copper or zinc tip, — abd., reversing poles at close to loosen tips, for 1-3 min. Repeat p. r. n.

Fissure, Anal (See Anus, Fissure of)

G. con., + copper or zinc tips, lab., — abd., or back, 5 ma., till tissues color green, weekly.

Fissure, Nipples (See Fissure Anal)



Fistula Electrode, copper.

Fistula

G. con., same as for fissure and ulcer.

Flexions, Uterine (See Displacements)

Foreign Bodies

Metallic substances are easily detected by the electric probe, or the X-ray, with fluoroscope, and radiograph.

Frequent Micturition (See Cystitis, Bladder, Irritable)

Fractures

Detected by the X-ray, with fluoroscope, and radiograph. Pain relieved by Bennett magnetone.

Freckles (See Hairs, Superfluous, Blemishes)

G. con., — needle under spot. Technique same as for the removal of superfluous hairs. Fulguration.

Frost-bite (See Chilblains)

Functional Impotence (See Impotence, Emissions)

Functional Nervous Diseases

S. ins., 15-20 min., daily. Vapor baths. C. g., and g. f. Ozol inhalations, 20-40 min., daily.

Furuncle (See Boils)

GALACTORRHOEA (See Bust Development)

To DIMINISH: G. con., + with concave clay or cotton pad elect., or Bennett disc, over towel, over breasts, — back, 10-20 ma., 15-30 min., daily.

To INCREASE: F., (coarse coil), sponge elect., lab., to breasts, electric massage. G. con., wet sponge pad, — to breasts, + spine. 10-15 ma., 20-30 min., daily. Vac. elect., with either mode, — to breasts, + back pad. H. f., body elect., to breast, 10 min., daily. Magnetic wave bath.

Galvanization, General, and Central (See page 189)

Gastralgia

G. con., to pneumogastric nerve, + in fossa below left ear, — top sternum, 5-10 ma., 10-15 min., gradually increase and decrease, swelling mode. G. con., + over stomach, — seat or feet, 10-20 ma., 5-20 min., daily. F., sec., (fine coil, rapid vibrator), over stomach, to back. S. ins., and shower. Violet light, 20 min., daily. Ozol inhalations, 20-40 min., daily. H. f., body elect. Auto-condensation, 15 min., daily.

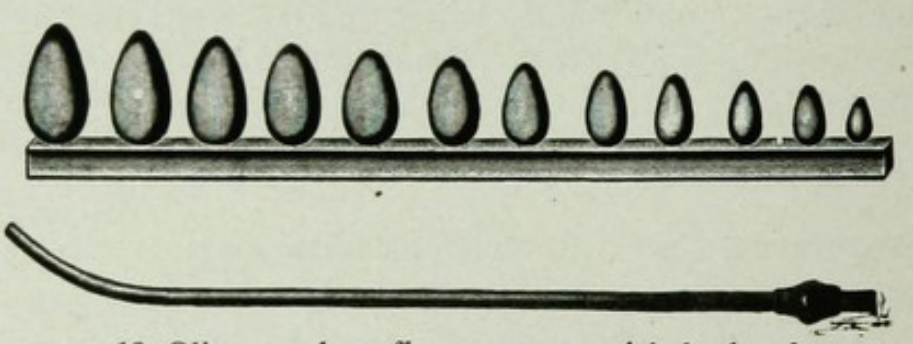
Gastritis (See Gastralgia, Atony of Stomach)

Gestation, Ectopic (See Fibroids)

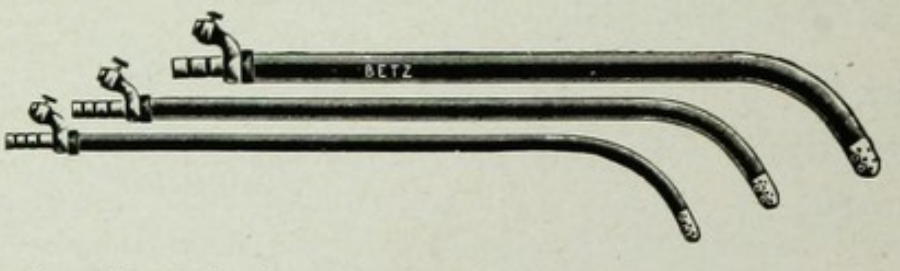
G. int., — in rectum, or vag., nearest to sac, + Bennett disc, abd., slow int., 20-80 ma., 10-20 min., daily. G. alt., same way. F., sec., (coarse coil, slow vib.), same way. After growth is checked, treat same as a fibroid.

Glands, Enlarged (See Tuberculous Glands, Goiter)

G. con., — over gland, with or without cat., of potass. iod., Bennett, phoric, + opp. G. alt., same way, 10-20 ma., 10-20 min., daily, or e. o. d. S. s., or spray. Helios violet light, 15 min., daily. Ozol inhalations, 20-40 min., daily.



12 Olives and staff, copper or nickel plated.



Overall's Irrigating Phoric with medicine bulb. For any Fountain Syringe. 3 sizes.

URETHRAL ELECTRODES

Glandular Development (See Bust Development, Penil)

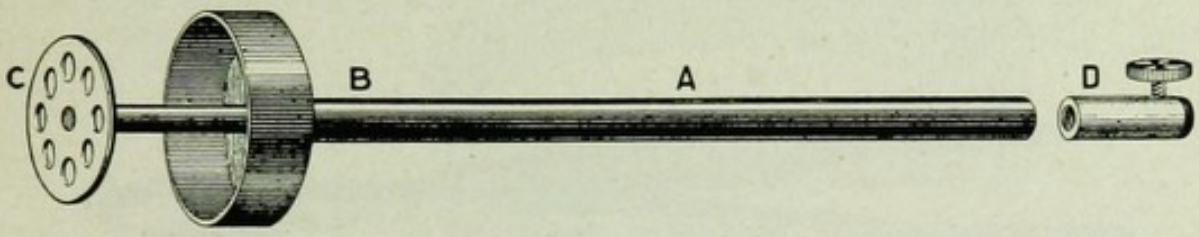
Glaucoma (See Eye Diseases, Glaucoma)

Gleet (See Strictures)

G. con., bare urethral or stricture tip, same as strictures, or g. con., + copper tip, lab., in urethra, — thigh pad, 3-10 ma., 3-6 min., e. o. d. G. con., with prostatic phoric elect., + for copper effect, — potass. iod. effect. If any inflammation, use soluble hydro-electric set, with copper and warm water, + in urethra, — on leg. H. f., urethral vac. elect., or rectal vac. elect., 10-20 min., daily or e. o. d., p. r. n. Body vac. elect., to perineum.

Goiter, Exophthalmic (See Eye Diseases)

G. con., — to hydro-elect., eye cup, + nucha, 2-3 ma., 3-8 min., daily, or e. o. d. S. spray, to eye and neck, 10 min., daily. H. f., eye vac. elect., auto-condensation, 15 min., daily or e. o. d. Magnetic wave bath.



THE BENNETT IMPROVED SLIP CENTER ALUMINUM DISC FORIC

Saves expensive drugs. You should have one each for cocaine and iodide of potash. Will save the price in a short time. Unscrew binding post (D) from stem (A), slip out rod and disc (C) from cup (B). Cover disc with cotton, tucking behind it. Replace and screw on post. Wet cotton with drug to be used. Simple, strong and durable.

Goiter (See Glands, Enlarged)

G. con., — sat. sol. potass, iod., with Bennett phoric elect., + opp., 10-20 ma., 10-20 min., daily, treat same as enlarged tuberculous glands. G. con., puncture may be used by is dangerous, and is only mentioned to be condemned. H. f., surface elect., over gland. Helios violet light, 15 min., daily.

Gonorrhœa (See Gleet)

Gonorrhœal Rheumatism (See Rheumatism)

G. con., + to pain, — distant, 5-15 ma., 5-15 min., daily. Electro-vapor baths, daily, or e. o. d. S. vib., Bennett method, + to painful parts, 5-10 min., daily. Helios violet light, 15 min., daily. Bennett magnetone, 10-20 min., daily. Ozol inhalations, 20-30 min., daily. H. f., body vac. elect., 10 min., daily.

Gout (See Arthritis, Rheumatism)

G. con., ana., + to joint, Bennett phoric, — in hands, 5-10 ma., 15-20 min., daily. G. con., cat., potass, iod., or lithia iod., sat. sol., — to lesion, + near by, 10-20 ma., 10-20 min., daily, or e. o. d. S. s.,

mild, to joint. S. ins., and spray, 10-15 min., daily. Helios violet light, 20 min., daily. Bennett magnetone, 10-20 min., daily. Ozol inhalations, 30 min., daily. Hydro-elect, baths, p. r. n. H. f., body elect., 10 min., daily. Auto-condensation. Magnetic wave bath.

Granulated Eye-lids (See Eye Diseases, Trachoma)

Gray Hair

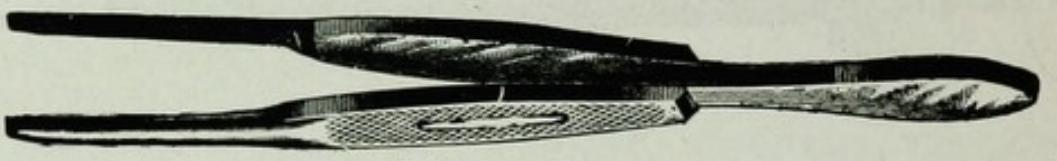
H. f., body vac. elect., to scalp, e. o. d.

Growths, Small (See Blemishes, Epithelioma, Moles, Nævus, Warts)

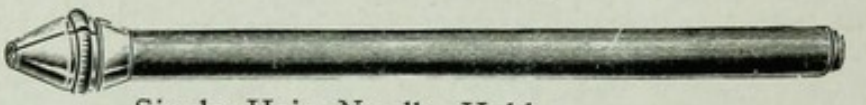
HABITUAL ABORTION (See Abortion, Habitual)

Hæmatocele, Pelvic (See Hemorrhage)

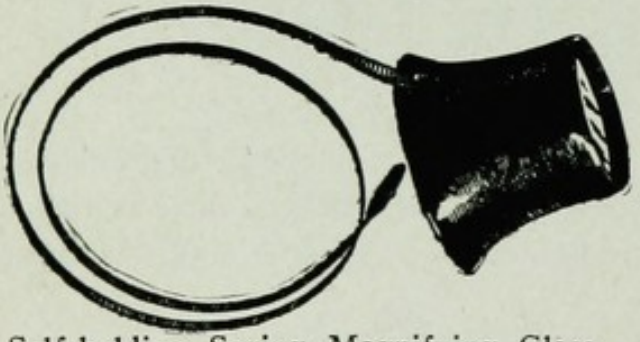
G. con., + carbon elect., in vag., near lesion, — Bennett disc, 25-100 ma., 5-20 min., e. o. d., p. r. n.



Epilation Forceps.



Single Hair Needle Holder.



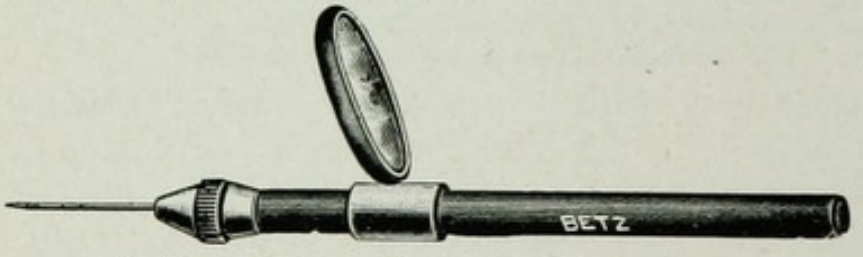
Self-holding Spring Magnifying Glass.



Head-band Eye-glass.



Needle in hair follicle.



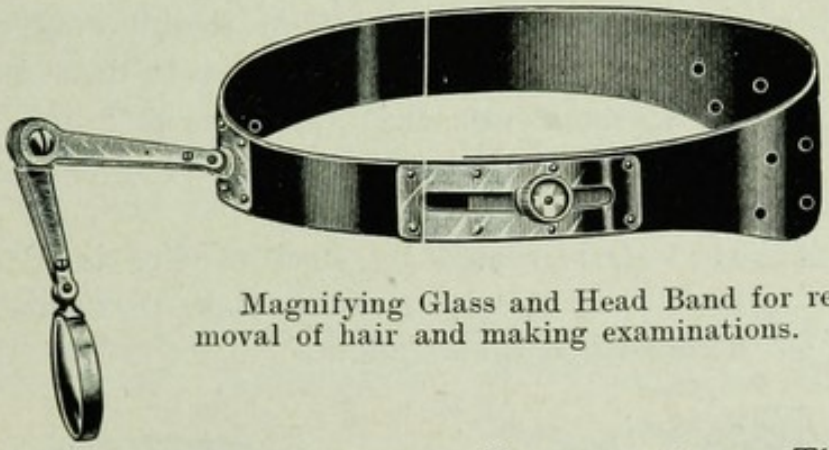
Needle Holder with magnifying glass.

Hair, Gray (See Canities, Gray Hair)

Hair, Superfluous (See Blemishes)

G. con., — fine steel needles, blunt, + in hand, mild, 4-8 ma., ½-1 min. Insert needle beside hair in follicle down to papilla, then

patient completes circuit by placing other hand on wet + pad. Needle is first inserted, using a slight rotary motion. Use only round blunt needles, held in a single holder (see cut), when a froth appears, gently pull on hair with forceps (see cut), and hair lifts out, without force. A self retaining magnifying eye glass, is essential, and rests the eye (see cut). Do not take out hairs too close together. Never use the + pole to needle. Apply some local anæsthetic, to skin before, and bleach, with witch hazel afterwards. X-ray, soft tube. short seance, frequent. Just short of producing dermatitis, till hairs fall out. They will return, but paler and weaker. Repeat raying,



Magnifying Glass and Head Band for removal of hair and making examinations.

and continue every 3 or 4 mos., till none return. The fine lanugo hairs, if dark, may be bleached white with peroxide of hydrogen.

Hay Fever (See Fever, Hay)

Headache (See Pain, Brain Troubles, Head-pains)

G. con., + over pain, — opp., sponge pad, 2-4 ma., 3-10 min., till relieved. S. ins., and spray, local over pain, 2-10 min. Russian violet light, 5-10 min. Bennett magnetone, 2-5 min. H. f., elect., hand, 5 min. If anæmic: Place poles just reverse of above. Operators hand may be used as an elect., passing it over wet skin, lab., mode passing through his body. S spray, or shower, 15-20 min., daily. Bennett head magnetone. Ozol, to improve the blood. If hyperæmic: G. con., + to forehead, — nucha. Electro-vapor baths. G. f. S. ins., and + shower, 10 min., daily. H. f., body elect., over pain., 5 min., p. r. n. Magnetic wave head bath.

Hemicrania (See Headache)

Hemiplegia (See Paralysis, Apoplexy)

Hemorrhage, Cerebral (See Apoplexy)

No treatment before the third wk., or till all active inflammation subsides. Then if painful: G. con., + over lesion, — opp., long., trans.,

or diag., 3-6 ma., 3-6 min., daily. Later, if no pain: G. con., — over lesion, large sponge pad, + nucha, 3-10 ma., 3-10-15 min., daily. Bennett head magnetone, 10-40 min., daily.

Hemorrhage, Post-Partum (See Obstetrics, Uterine Inertia)

F., (coarse coil), one pole int.-ut., other to Bennett disc. Continue p. r. n.

Hemorrhage, Uterine (See Menorrhagia, Metrorrhagia, Obstetrics)

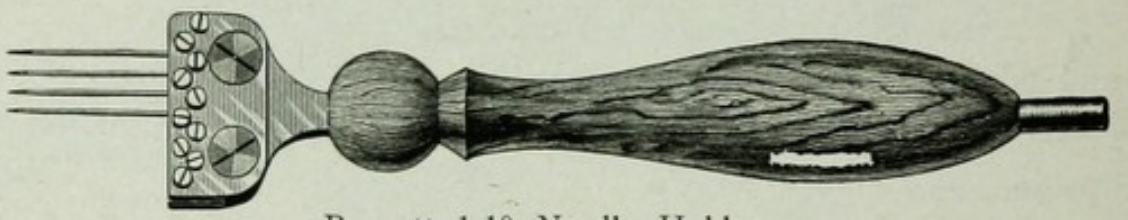
G. con., copper tip, + int.-ut., — abd., Bennett disc, 20-40 ma., 20-40 min., e. o. d. Reverse poles, 5 min., to loosen tip at finish.

Hemorrhoids (See Growths, Small)

G. con., + copper elect., either bare, or preferably covered with cloth, cotton or leather, wet, to pile, — abd., Bennett disc, 5-12 ma., 5-10 min., e. o. d. H. f., rectal vac. elect., 10 min., p. r. n.

Bleeding: Bare copper or zinc tip, g. con., + to pile. May be applied per specula, lab., — to abd. Ful.

Hard External: Best treated by steel needles in Bennett holder. G. con., — to needles in pile, + back or abd., 10-20 ma., 10-20 min., p. r. n. One seance usually enough.



Bennett 1-10 Needle Holder.



Massey's Platinum-Point Hemorrhoidal Needle.

Herpes Zoster

G. con., — to lesion, + opp., 5-10 ma., 10-20., min., daily. G. con., cat., Bennett phoric, with potass. iod., local, + opp. S. s., or spray, local, daily. Helios violet light, 15 min., daily. H. f., body elect., 10 min., daily. Magnetic wave bath. Body magnetone.

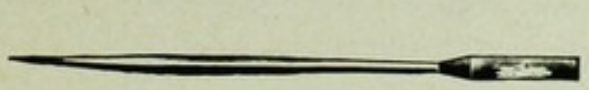
Hiccough (See Spasm of Diaphragm)

G. con., to pneumogastric nerve, + in fossa under left ear, — top sternum, 5-10 ma., 5-10 min., hourly till checked. Body magnetone. Magnetic wave bath.

Hives (See Hyperæsthesia of Skin)

G. con., — plain wet sponge elect., or Bennett phoric, ana., stovaine, to lesion, — distant, 5-10 ma., 10-20 min., till relieved. S. ins., or spray, + to lesion, — feet, 10-20 min., or till relieved, daily. Elec-

tro-vapor baths. Helios violet light, 15 min., daily. H. f., body vac. elect., 10 min., daily. Magnetic wave bath.





Hydrocele (See Varicocele)

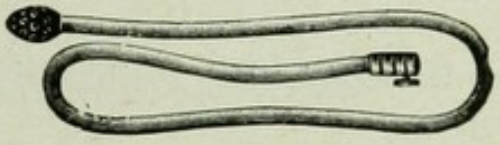
G. con., — to fibroid spear, driven into the fluid sac., + on thigh, 5-10 ma., 5-10 min., or withdraw a little fluid, and inject same amt., sol., potass. iod., (10-20%), and treat as above, or can apply scrotal clamp elect., to — pole, same as for varicocele.

Hyperæmia, Cerebral (See Brain Troubles)

Hyperæsthesia of Skin

Hydro-electric bath. G. con., + elect., in water, — to part above water, 5-10 ma., 10-20 min., daily. Helios violet light, 15 min., daily. G. f. S. ins., and roller, 15 min., daily. H. f., body vac. elect., 10 min., daily. Body magnetone. Magnetic wave bath.

Stomach or Rectum, Einhorn's with hard rubber perforated olives.



Hyperæsthesia of Stomach

G. con., + over stomach, — back, 10-15 ma., 10-15 min., daily. F., (long fine coil), sec., same way. Hydro-electric method, stomach elect., swallowed, and stomach filled with water (see cut above). H. f., auto-condensation, 15 min., daily.

Hyperæsthesia, Urethral (See Urethra Hyperæsthesia)

Hyperidrosis

G. con., + to water foot bath, in sol. antiseptics, — in hands, 5-15 ma., 10-15 min., daily. Electro-vapor baths, daily. Helios white light, 10 min., daily. X-ray, over feet or axillæ, soft tube, often, short exposure, p. r. n., e. o. d.

Hyperplasia (See Sub-Involution)

Hypertrichosis (See Hairs, Superfluous)

Hypertrophy, Turbinate

G. con., + platinum or gold needles, puncture, in lesion, both poles close together, 5-20 ma., (cocaine), 5-10 min., wkly. G. con., — steel needle, single, (see cut over Hairs), puncture in lesion, + in hand, cocaine local anæsthesia, 5-10 ma., 5-10 min., wkly. Galvano-cautery knife, direct to lesion, wkly., p. r. n.

Hypertrophy, Prostatic (See Enlargement of Prostate)

Hypertension (High blood pressure)

H. f., auto-condensation, auto-conduction. Body magnetone. Avoid sparks to spine. Minin light bath. Magnetic wave bath.

Hypotension (Low blood pressure)

H. f., sharp sparks to spine, body vac. elect. S. ins. S. s., and roller. G. g., c. g., g. f. Electro-vapor bath. Red and white light bath. Body magnetone. Magnetic wave bath.

Hypochondria (See Neurasthenia)

G. f., and c. g., and g. g., e. o. d. G. con., lab., + spine, — feet, 10-15 ma., 10-20 min., daily. S. ins. S. s., spine. S. shower. S. roller, spine, 15 min., daily. Red helios light to spine, 15 min., daily. Ozol 20-40 min., daily. Do not use high frequency. Head magnetone. Magnetic wave bath.

Hysteria (See Neurasthenia, Displacements)

Treat same way as hypochondria, but particularly examine for, and properly treat any uterine derangements, p. r. n. Do not use high frequency. Head magnetone. Magnetic wave bath.

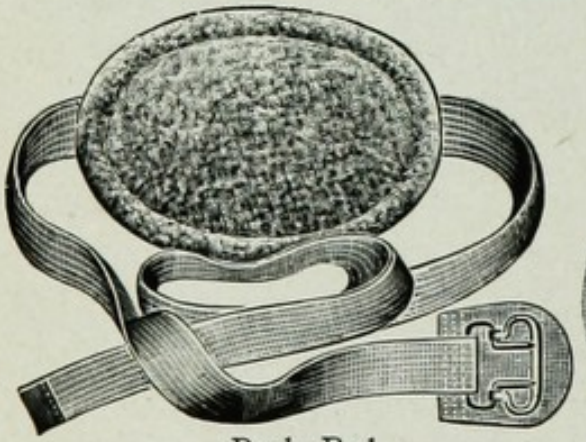
Hystero-Epilepsy (See Epilepsy, Hypochondria, Melancholia, Displacements)

G. con., + on long spinal pad, (2 x 12), — abd., Bennett disc, or feet, 20-30 ma., 20-25 min., daily. Same with s. ind. Carefully examine clitoris and whole genito-urinary tract for derangements, which properly treat, p. r. n. Head and body magnetone. Magnetic wave bath.

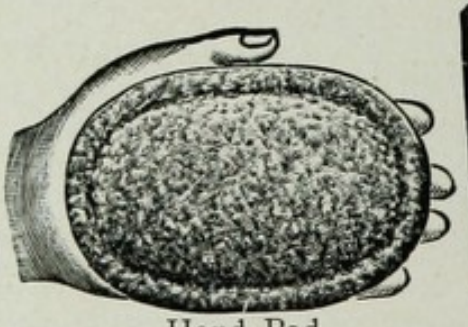
ICTERUS (See Jaundice, Liver Cirrhosis)

Impaction, Fecal

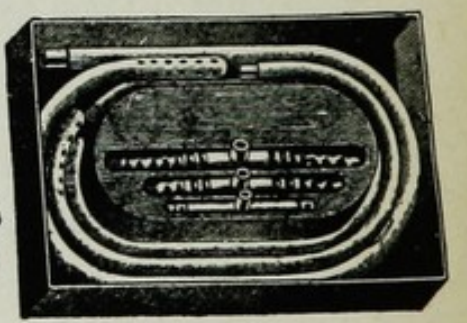
G. int., or alt., patient in knee-chest posture, fill bowel with water,



Back Pad.



Hand Pad.



Colon Irrigating Set.

insert a long colon tube elect., (see cut), high up, attach to one pole, other to abd., or back pad, 20-80 ma., slowly, int., or alt., 15-20

times per min., for 5-10 min., daily. Usually first sitting enough. Local roller or hand pad, (see cut), massage, lab., over colon. S. ind., or f. prim., or sec., (coarse coil), from back, to abd., 10-15 min., daily, or same stab., front to back, (see cut), daily.

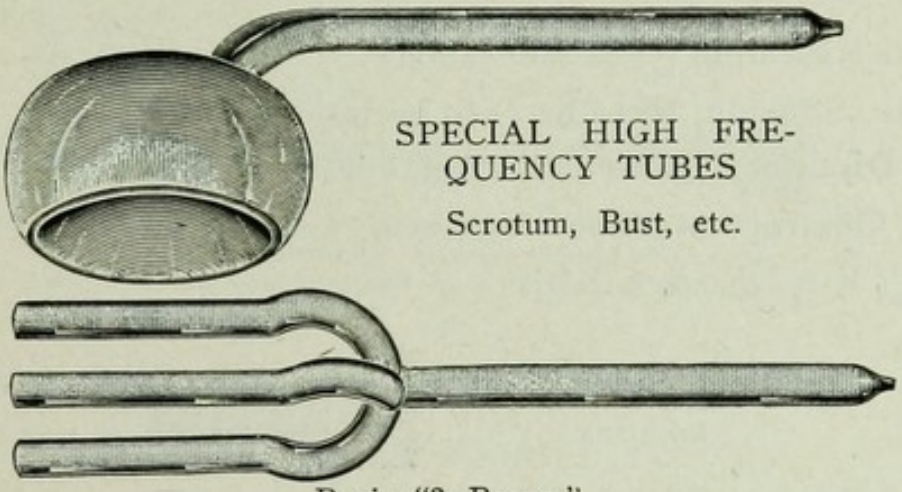
Impetigo (See Treatment of Acne)

Impotence (See Spermatorrhœa, Orchitis, Hemorrhoids, Ataxia, Debility)

As this trouble is but a symptom, the cause must be found and removed, and the conditions treated, p. r. n. C. g., and g. f. Electro-vapor baths. Ozol, 30 min., daily, to improve the blood. H. f., rectal vac., or body elect., 10 min. daily., spine and perineum. Magnetic wave bath.

Incontinence of Urine (See Urine Incontinence, Bladder Irritable)

G. con., + spine, — feet or perineum, 10-15 ma., 5-10 min., daily. F., in urethra or bladder or rectum, or above pubes, or perineum, and other pad on sacrum, mild dose, (med. coil), 10-15 min., daily. S. s., to sacrum, and spine, 5 min., daily. H. f., rectal vac. elect., and spine, 10 min., daily.



SPECIAL HIGH FREQUENCY TUBES

Scrotum, Bust, etc.

Penis "3 Prong."

Indigestion (See Atony of Stomach, Dyspepsia)

Inertia, Uterine (See Hemorrhage, Post-partum)

F., (coarse coil), sec., or prim., bipolar, int.-ut., or one pole int.-ut., other vag., or abd., 5-10 min., swelling mode, hourly. Repeat, p. r. n.

Infantile Paralysis (See Paralysis)

Inflammation (See Pain, Appendicitis, Sprains)

G. con., + to lesion, stab., — opp., mild dose, short treatment, often, p. r. n. S. spray, local, p. r. n. Helios violet light, 20 min., daily. H. f., body vac. elect., local, auto-condensation, p. r. n.

Injections, Electric (See Impaction, Fecal)

Insanity (See Brain Troubles, Headache, Hypochondria, Hysteria)

C. g., mild, g. f., daily, p. r. n. If maniacal: treat same as for hyperæmic headache. If melancholic: treat same as for anæmic headache. S. ins., and spray. S. s., to spine, 10-15 min., daily. Electric light general bath. Russian violet light. Bennett head magnetone, 20-30 min., daily. Magnetic wave bath.

Insomnia (See Brain Troubles)

G. con., + to forehead, — nucha, 2-3 ma., 10-15 min., daily, in eve.; or + nucha, — epigastrium, c. g., 5-10 ma., 5-10 min., daily; or + to 7th cervical vertebra, — coccyx, 10-15 ma., 10-15 min., daily. S. vib., Bennett method, hand pad, + to spine, or nucha, — feet, (especially good for cold feet), 10 min., daily. H. f., body elect., forehead, temples, nucha, spine 5 min., auto-pad, 20 min., daily. p. r. n. Head magnetone. Magnetic wave bath.

Insulation for Needles

Coat all but points with shellac. Dry till hard, and use in Bennett needle holder.

Intercostal Neuralgia (See Neuralgia)

Interstitial Diffusion, Metallic (See section two)

Intestinal Diseases (See Constipation, Diarrhœa, Impaction, Obstruction)

Intestinal Obstruction (See Impaction, Obstruction)

Iritis (See Eye Diseases, Iritis)



Spinal Sanger-Brown's block tin back pad.

Irritation, Spinal (See Spinal Meningitis, Neurasthenia, Sexual)

G. con., + nucha, — sacrum, or feet, 10-15 ma., 10-15 min., daily. C. g. S. vib., Bennett method, + spine, (2 x 12 pad), — feet, 10-15 min., daily. Helios violet light, to spine, 15 min., daily. Body magnetone. Magnetic wave bath.

JAUNDICE (See Liver Cirrhosis)

G. f. G. int., lab., massage roller, or sponge pad, — over liver, + feet, 10-20 ma., 15-30 min., e. o. d. S. vib,. Bennett method, + feet, — abd., 15 min., daily. Ozol, 30 min., daily.

Joints Enlarged (See Arthritis Deformans)

If painful: G. con., + to joint, — distant. If not painful: — to joint, + opp. G. con., potass. iod., sat., sol., — on Bennett phoric,

+ opp., cat., 10-20 ma., 10-20 min., daily. Helios violet light, 15 min., daily. Bennett arm or leg, magnetone, 30 min., daily. S. vib., Bennett method, + to joint, if pain, — if not, other pole distant, 5-15 min., daily.

KELOID

X-ray, med. tube, 8-10 in. away, 5-10 min., daily. With a soft tube, must produce slight vesiculation, sometimes repeated. Prognosis good H. f., sharp, sparks. Ful.

Keratitis (See Trachoma)

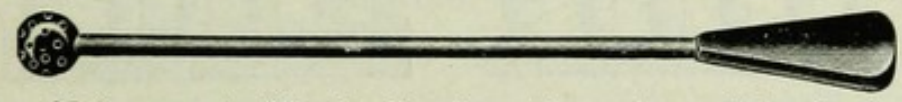
X-ray soft tube. Treat same as trachoma. Slight stimulation only needed. If over treated, makes worse. Ray, p. r. n.

Keratosis

X-ray, soft tube, mild, just enough to get slight dermatitis only required. Prognosis good, especially senile form.

Kidney Diseases (See Bright's Disease, Diabetes)

F., sec., mild, int., 60 per min., back to abd., 30 min., daily. Body magnetone, magnetic wave bath.
Ozol, 30 min., daily.



Neiswanger's Phoric Cervix with perforated hard rubber ball. Platinum terminal which should be covered with moist cotton for treating lacerations of the cervix, with thiosinamin.

LACERATIONS, CERVICAL (See Erosions, Scar)

Lachrymal Duct, Stricture of (See Strictures)

Lactation, Deficient (See Galactorrhœa, to produce)

Lactation, Excessive (See Galactorrhœa, to decrease)

Lateral Sclerosis (See Paralysis, Hyperæsthesia of Skin)

Hydro-electric baths. G. con., 15-20 ma., 10-20 min., e. o. d. C. g., daily, 10-15 ma. G. con., —spine pad, (2 x 12 in.), + feet, 18-20 ma., 10-20 min. e. o. d. Helios violet light to spine, 15 min. daily. Body magnetone. Magnetic wave bath.

Lead Paralysis (See Paralysis)

Leprosy

X-ray, med. tube, 5-10 in. away, 5-10 min., daily, follow with helios violet light, 15 min.

Leprosy

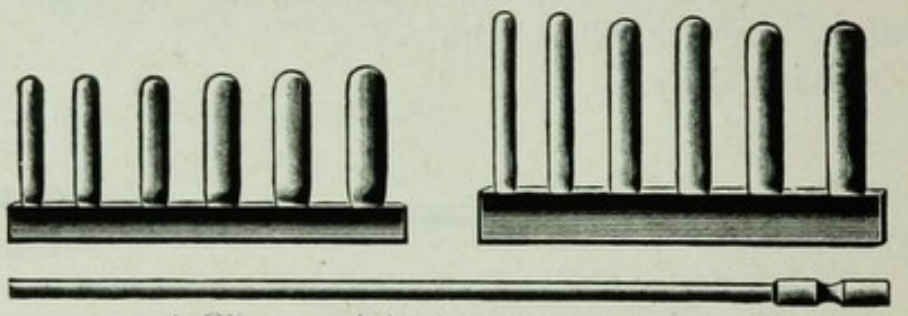
The X-ray is being used with excellent results by many operators, in early stages. It is yet too soon to report prognosis.

Leucorrhœa, Uterine (See Metritis, Displacements, Sub-Involution)

G. con., + bare copper tip, int-ut., — abd., Bennett disc, 15-25 ma., 10-20 min. e. o. d., reverse poles, 1-2 min., to loosen tip. G. con., nickel or aluminum tip, — int.-ut., + abd., 10-20 ma., 10-20 min., e. o. d. Hydro-electric douche, with soluble elect., daily. "Find out the cause" and correct. H. f. vag. vac. elect. 15 min. e. o. d.



Electric Vaginal and Rectal Irrigator.
For any fountain syringe.



6 Olives and Staff, copper or zinc.

Leucorrhœa, Vaginal

G. con., + copper tip covered, vag., — abd., Bennett disc, 15-20 ma., 15-20 min., e. o. d. G. con., — nickel tip, bare lab., vag., + abd., as above. Hydro-electric douche, soluble elect., p. r. n. H. f. vag. vac. elect., 15 min. e. o d

Leukemia

X-ray, med. tube, over spleen and long bones, 10-15 min. daily. Ozol, 30 min., daily. Auto-condensation. Body magnetone. Magnetic wave bath.

Lichen, Planus, and Rubra

H. f. body vac. elect. mobile. Body magnetone. Magnetic wave bath.

Lipoma

X-ray, med. tube, 5-10 in. away, 5-10 min., daily or e. o. d., p. r. n.

Lithemia (See Gout)

Liver Cirrhosis (See Jaundice)

G. f. G. int., lab., — over liver. + back, stab., 10-20 ma., 10-20 min., daily, slow int. S. vib., Bennett method, — abd., + feet or back. Ozol, 30 min., daily.

Liver Diseases (See Liver Cirrhosis, Jaundice)

Hall's Carbon for bleaching the skin with a galvanic.



Liver Spots (See Cholasma)

G. con., — sponge to spots, lab., + in hand, 5-10 ma., 5-10 min., daily. Ozol, 30 min. daily. Electro-vapor baths, e. o. d., p. r. n.

Local Anæsthetic (See pages 164, 165)

Locomotor Ataxia (See Lateral Sclerosis, Hyperæsthesia of Skin)

G. con., — to spine pad, (2 x 12 in.), + feet, 10-20 ma., 20-30 min., e. o. d. Hydro-electric bath. Electro-vapor baths, e. o. d. S. s. to spine, mild, 5 min., daily. S. spray, and roller, 5 min., daily. Few, if any, cases, will be cured, but the pains of many will be relieved. H. f. body vac. and auto-pad, 5-15 min. daily., p. r. n. Ozol inhalations, 30-60 min. daily. Magnetic wave bath.

Lumbago (See Rheumatism, Muscular)

G. con., + sponge pad, lab., or stab., to back over pain, — in front on abd., 10-20., ma., 5-15 min., daily, often one seance is a cure. Helios violet light over back, 15-20 min., daily. H. f. body vac. back and auto pad, 10 min., p. r. n. Body magnetone. Magnetic wave bath.

Lupus (See Tuberculosis)

G. con., + bare copper tip to lesion, lab., — near, stab., 5-10 ma., till surface turns green. Dip tip into brine, to hasten effect, by forming an oxy-chloride of copper, ana. X-ray, with Allen shield, to protect healthy parts. Ray daily, or e. o. d., p. r. n., 5-10 in. away, 3-10 min., soft tube, till gray exudate appears, then less often, p. r. n. Continue 1-6 mos., or till cured. Follow each radiation with the helios or Russian, violet light, 15-20 min., to hasten effect, and prevent burn. H. f., ful.

Lymphatics, Enlarged (See Glands, Enlarged)

MALINGERING (See section two)

Mammary Cancer (See Carcinoma)

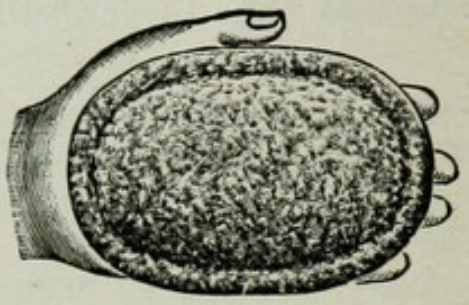
Mania (See Brain Troubles, Insanity)

Marasmus (See Debility, General)

G. g., g. f., and c. g. S. ins. S. s., spine. S. roller. Med. doses, 10-20 min., daily. General tonic treatments. Electro-vapor baths. Electric light baths, S. cage. Magnetic couch. Body magnetone. Stimulate catalysis, and tissue metabolism. H. f. auto-condensation. Magnetic wave bath.



Roller.



Hand Pad, soft rubber back.

Massage, Electric

Bipolar roller may be used local, or one pole to body of patient, stab., other to roller, or sponge pad, and applied by operator, lab.; or operator may hold other pole in his left hand, and apply his right hand as an elect., with massage, called "The electric hand."

Mastitis (See Abscess, Mammary, Galactorrhœa, to diminish)

Mastoiditis (Mastoid Abscess)

H. f. white vac. body elect., over mastoid, 30 min., p. r. n. Auto-condensation.

Melancholia (See Headache, Hypochondria, Insanity)

G. con., — nucha, + spine or feet, 10-15 ma., 10-20 min., e. o. d. G. f. S. s. spine. S. spray and roller, 20 min., daily. Helios red light bath. Electro-vapor baths, daily. Ozol, 30 min., daily. Do not use high frequency. Head magnetone. Magnetic wave bath.

Meningitis (See Brain Troubles, Spinal Meningitis)

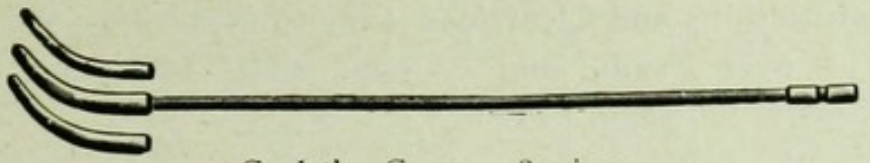
G. con., + parietal, — under ear, 1-3 ma., 2-5 min., daily, or — sternum, + back, 5-10 ma., 10-15 min., daily. S. ins., S. shower, 15 min., daily. Russian violet light to nucha and spine. Bennett head magnetone. Magnetic wave. 15 min., daily. H. f. auto condensation, p. r. n.

Menopause, Disorders (See Neurasthenia)

G. con., — int.-ut., + abd., 20-40 ma., 20-25 min., wkly. F. sec., same way. S. ins. S. shower. S. s. spine, S. surge. S. vib., Bennett method, + abd., or feet, 10-15 min., daily. Magnetic wave bath. Ozol, 30 min., daily. H. f. body vac. to spine. Auto-condensation, 20 min. daily, p. r. n.

Menorrhagia (See Hemorrhage, Post-Partum, Uterine)

G. con., + copper, tin or zinc tip, bare, int.-ut., — abd., 20-200 ma., 5-20 min., e. o. d. Reverse poles to loosen tip. Repeat, p. r. n.



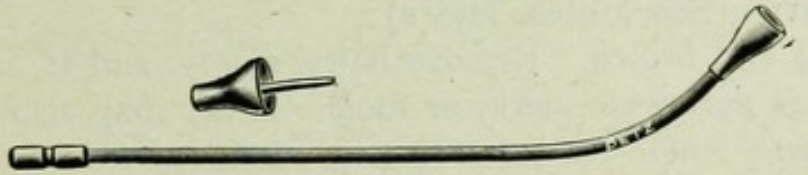
Goelet's Copper, 3 sizes.

Metritis (See Displacements, Leucorrhœa, Sub-Involution)

G. con., + bare copper or zinc tip, int.-ut., — abd., Bennett disc, 20-100 ma., 10-20 min., e. o. d. G, con., — int.-ut., + abd., or sacrum, 15-30 ma., 10-20 min., e. o. d.

Metritis, Peri- and Para-, Acute

F. sec. (long fine coil), bi-polar, int.-ut., and vag., 15 min., daily. Sin., same way. G. con., + abd., — sacrum, 20 min., daily.



Cup for Uterus, plated or copper.

Metritis, Sub-Acute, and Chronic (See Metritis)

Metrorrhagia (See Menorrhagia)

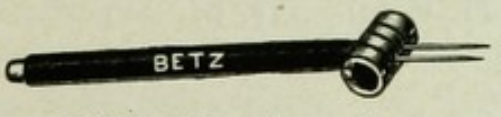
Micturition, Frequent (See Bladder, Irritable, Urine, Incontinence)

Migraine (See Neuralgia)

Miscarriage (See Abortion, Hemorrhage, Post-Partum, Obstetrics)

Moles (See Growths, Small, Carcinoma, Epithelioma, Warts)

G. con., steel needles, Bennett holder, — under base, + in hand, 5-10 ma., 5-10 min., p. r. n. Reinsert needles at right angles, and repeat. One sitting enough.



Kelly's, for 4 needles.

Moles, Hairy (See Hairs, Superfluous, Nævus)

Remove hairs first, then treat same as a simple mole. If small, often the removal of the hairs alone will remove the mole. Ful.

Muscular Atrophy (See Atrophy, Muscular, Massage)

F. sec., massage, electric hand, or roller. G. con., spine. G. g. and g. f.

Muscular Contractions and Cicatrices (See Contractions, Scars)

G. con. — over lesion, lab., + opp., stab., 10-15 ma., 10-20 min., daily. Electric massage, p. r. n.

Myalgia (See Rheumatism, Muscular, Lumbago)

Mycosis, Fungoides

X-ray, soft tube, moderate radiation. Almost a specific. Helios violet light, 15 min., daily.

Myelitis

G. con., + nucha., — lumbar spine, 5-15 ma., 10-20 min., daily. G. alt., spine to sternum. S. s., to spine. Helios violet light, to spine, 15 min., daily. Body magnetone, 30 min., daily. Magnetic wave, 30 min., daily. Ozol, 20-30 min., daily.

NAEVUS, Hairy (See Moles, Hairs)

Usually fine and brown. Remove hairs, singly, and if mark remains, treat same as port wine mark, or mole. X-ray may also be used, but is very slow.



Needle Disc for removing Pigmentary nævus or wine marks.

Nævus, Port Wine Marks (See Blemishes)

G. con., — steel needles, in nævus elect., (see cut), needles driven into mark vertically, + near, 2-5 ma., 2-5 min. Move needles around to different places. Several seances best, if extensive. Allow one spot to heal before treating again near it. G. con., ana., 5-10 ma., 5-10 min., with Bennett phoric, cocaine, preferably used first. Chromethylate sodium may be applied afterward to hasten effect. (See note.) Nævus needles leave numerous minute punctate scars, which are not as much a blemish as nævus, and which gradually disappear, in a year or two. H. f. ful., p. r. n.

Nævus, Vascular

G. con., — steel needles, Bennett holder, from 1-10 needles introduced, under base, and parallel to surface, + near, 5-10 ma., 5-10 min., p. r. n. Remove needles, and reinsert them, at right angles to 1st insertion, and repeat dose. One seance usually enough. First use cocaine, ana., local, with Bennett phoric, to prevent pain, 5-10 ma.,

5-10 min. G. con., + small cotton or sponge elect., to mark, wet with chromethylate sodium, — near, 5-10 ma., 5-10 min. In small children, can use sodium alone. Apply lightly to surface, being careful not to touch surrounding skin. Allow to dry. Surface blackens and peels off. Then repeat, p. r. n., till cured. In any treatment do not allow the scab to be picked off. Keep it soft with yellow oxide of mercury ointment. When it falls off it leaves a healthy granulating surface, which treat with ordinary antiseptics, and Minin violet light, 15 min., daily. White scar results, which gradually turns red, then fades to natural color in from six mos. to a yr. If large, treat but a part at a time, p. r. n. H. f. ful., p. r. n.

NOTE:—Chromethylate of sodium is prepared as follows: Take equal parts of crystals of chromic acid, and ethylate of sodium, and mix in a salt mouth bottle, with a few drops of water. Heat generates, so keep in a cool place; when cool, and deliquesced, it is like thick, dark molasses. Keep stoppered, and thin as needed, and apply with a match or toothpick. It takes several days to prepare, and the older it is the better it works.

Nasal Spurs

G. con., + and — needles, platinum, close together, puncture (after cocaine), 5-10 ma., 3-5 min., e. o. d. G, cautery, p. r. n.

Nasal Stricture (See Strictures)

G. con., — wkly, same as for stricture elsewhere, p. r. n.

Nasal Hypertrophy (See Hypertrophy, Turbinate)

G., same as above, or linear galvano-cautery.

Nervous Diseases, Functional (See Functional Nervous Diseases)

Nettle Rash (See Urticaria, Hives)

Neuralgia (See Pain, Head Pains)

G. con., + to pain, lab., or stab., — distant. On head: 3-5 ma., 10 min., daily. On body: 10-30 ma., 10-20 min., daily. F. sec. (very long fine coil), or sin., same as above. S. shower, or spray, 10-15 min., daily. S. ins., 15 min., daily. G. con., ana., + Bennett phoric, cocaine, chloroform, or aconite, local, 5-10 ma., 5-10 min., p. r. n. Bennett magnetone, 5-20 min., daily. H. f. body vac. elect. to part, auto-pad, 15 min. daily. Magnetic wave bath.

Neuralgia, Hysterical (See Hysteria)

Neuralgia, Trigeminal

G. con., + to pain, — nucha, 3-5 ma., 5-10 min., hourly, till relieved.

Ana., Bennett phoric, cocaine or aconite, over pain, 3-5 ma., 5-10 min., — in hands. S. spray, local, 10 min., daily. Helios violet light, 15 min. daily. Bennett head magnetone. Magnetic wave bath. H. f. body vac. elect. to part. Auto-pad, 15 min. daily. p. r. n.

Neurasthenia Cerebral (See Brain Troubles, Hypochondria, Headache)
G. con., + to forehead, — nucha, 2-5 ma., 3-10 min. daily. Treat same as for anæmic headache. Do not use high frequency.

Neurasthenia, General
G. con., +to head, neck or spine, p. r. n., — coccyx or feet. C. g., g. f. S. shower. S. ins., 20 min., daily. S. s., and roller, to spine, mild, 5 min., daily. S. surge. S. vib., Bennett method, e. o. d., or daily, p. r. n. Electro-vapor baths. Electric light baths. Bennett magnetone. S. cage. Magnetic wave bath. Ozol, 30 min., daily. Do not use high frequency.

Neurasthenia, Sexual (See Hypochondria)
G. con., — to steel sound in urethra, + sacrum, 5-8 ma., e. o. d. G. con., + spine, lab., — feet, 10-20 ma., 10-20 min., daily. S. surge. S. vib. Bennett method, + to spine, or perinænum, — feet, or crown, 10-15 min., daily. Begin with short vib., and slowly lengthen. Do not use high frequency. Body magnetone. Magnetic wave bath.

Neuritis (See Neuralgia, Brachial Neuritis)

Neuroses (See Functional Nervous Diseases, Writers' Cramp)

Non-Development (See Atrophy, Bust and Penil Development)

OBESITY
Electro-vapor baths, with electric massage, daily. Local vapor bath. S. surge, to abd. Sin., and f. sec. (coarse coil), lab., over abd., 15 min., daily. G. f., S. cage. Electric light baths. C. g., H. f., auto-pad, 30 min. daily. Body magnetone. Magnetic wave bath.

Obstetrics, Uterine Inertia (See Hemorrhage, Post-Partum)
F. sec., int.-ut., and abd. (short coarse coil) swelling mode, once per min., till contractions occur. Repeat hourly, as needed, p. r. n. F. sec., bipolar, int.-ut.

Obstetrics, Post-Partum Hemorrhage (See Hemorrhage, Post-Partum)
Treatment same as above.

Obstetrics, Retained Placenta, or Fœtus
Treatment same as above.

Obstruction of the Bowels (See Impaction, Fecal)

Occulsion, Intestinal (See Impaction, Fecal)

Occupation Neuroses (See Writers' Cramp)

Ocular Injures (See Eye Diseases)

Œsophagus, Paralysis (See Paralysis)

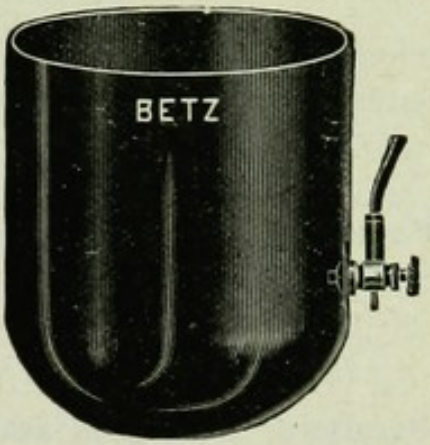
Œsophagus, Stricture (See Stricture)

Optic Nerve Atrophy (See Eye Diseases, Optic Atrophy)



Bennett's Porcelain Mug.

Scrotum cup for impotency, varicocele, etc. Filled with water or any medication and attached to any battery.



Overall's Cup, hard rubber.

Orchitis

ACUTE OR THREATENED: G. con., + in mug water elect. (see cut), in which scrotum is immersed, — sacrum or feet, 5-10 ma., 10-15 min., daily. Helios violet light, or bidet chair bath, 15 min. daily. H. f. body elect., 10 min. daily.

CHRONIC: G. con., — to mug bath, with sol. potass. iod., cat., + back, 5-10 ma., 5-10 min., daily.

Ovaralgia (See Neuralgia, Pain)

G. con., + over ovary, or in vag., — back, stab., 10-20 ma., 15-30 min., daily. F. sec. (long fine coil), or sin., front to back, abd.,



Neiswanger's vaginal phoric irrigator. For any syringe. For treating fibroid tumors, inflammation of ovaries, tubes, etc.

10-15 min. daily. Magnetic wave bath. H. f. body elect. 15 min. daily. Auto-condensation.

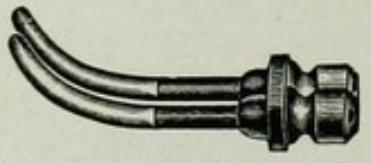
Ovaritis (See Ovaralgia, Pain)

Ozena

H. f. nasal vac. elect., 5 min., daily. Ozol, daily, 20-40 min.

PAIN

P. P. P. Always remember, g. con., + to pain. F. sec. (long fine coil). Sin., local. S. spray. G. con., ana., cocaine, in Bennett phoric, 5-10 ma., 5-10 min. Helios or Russian, or Minin violet light over pain. Bennett magnetone. Magnetic wave bath. H. f. body elect., 5-20 min., p. r. n. Auto-condensation.



Sharp's Nasal, double.

Pannus (See Eye Diseases, Trachoma, Keratitis)

G. con., + to cheek, stab. (under surgical anæsthesia), — to lesion, lab., slowly moving, 2-3 ma., 3-5 min., repeated, p. r. n. (See lesson 28, page 4.)

Paralysis, Diagnosis and Prognosis (See section two)

Paralysis

G. con., + stab., over sternum, — lab., over affected areas. Mod. dose up to tolerance. Repeat, p. r. n., but NEVER treat till all inflammation has subsided.

AGITANS: G. con., + to forehead, — nucha, 3-5 ma., 5-10 min., daily. Or + sternum, stab., — spine, lab., 10-15 ma., 10-15 min., daily. S. spray. S. shower. S. ins. S. s. To spine, 15 min. daily. Helios violet light to spine, 15 min., daily. Magnetic wave bath. H. f. auto-pad.

APHASIA ACUTE: (See Aphasia.) G. con., + over Brocha's speech center, — behind opp. ear, or on nucha, 3-5 ma., 3-5 min., daily. S. ins., 10 min., daily.

APHASIA, SUB-ACUTE, OR CHRONIC: (See Aphasia.) G. con., — stab., over left 3rd frontal convolution (Brocha's center), + on nucha, or opp. mastoid process, 3-10 ma., 5-10 min., daily. Increase and decrease mode very slowly. Bennett head magnetone, 30-40 min. daily. S. spray. S. shower, 15 min., daily. Magnetic wave bath.

BULBAR, CHRONIC: G. con., between mastoid processes. Change direction at each treatment, or several times at each treatment, without shock. G. con., to brain, long., trans., or diag., 5-8 ma., 5-10 min., daily. G. con., to pneumogastric nerve, + in fossa under left ear, —

top sternum, 3-5 ma., 3-5 min., daily. G. con., to sympathetic nerves in neck, trans., 5-10 ma., 5-10 min., daily. Same through pharynx. Sin., through region of throat, 5-10 min., daily. G. alt., slow and mild, 20 per min., 5 min., daily, to throat and neck. F. prim., with electric hand massage, externally, from throat to hands, 5 min., daily. (See Aphasia, Massage.)

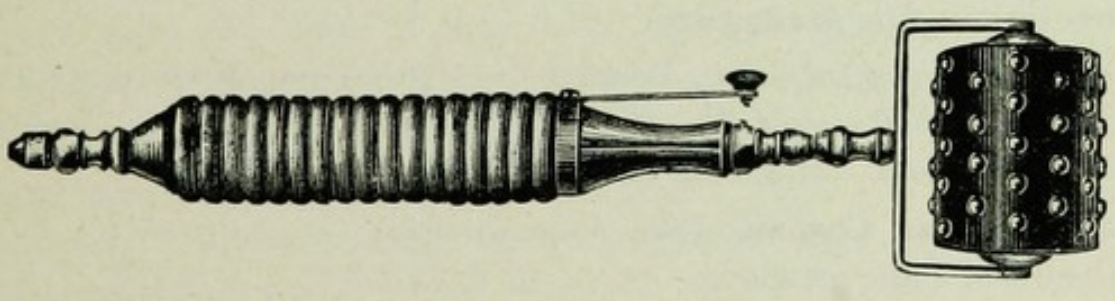
DIPHTHERITIC: Electric hand massage (See Massage, Aphonia), f. prim., or g. int., or sin., or s. ind., using hand as elect. with skin and hand wet. Apply externally, over throat muscles, lab., or apply two *small sponge pads,* lab., on opp. sides of throat, 5-10 ma., 2-10 min., daily.

FACIAL: G. con., — lab., over exit of nerves in front of ear, + nucha, stab., 2-5 ma., 5-10 min., daily. F. sec., electric massage to affected muscles, 5 min., daily. S. spray, to cheek. S. surge, or s. vib., Bennett method, — cheek, + hands; or — to cheek, + crown, 5 min., daily.

HEMIPLEGIA: (See Brain Troubles.) G. con., + nucha, stab., — on temple, and under ear, lab., 3-5 ma., 5-10 min., daily. (Only after all inflammation has subsided.) G. int., or f. sec. (coarse coil), lab., to affected muscles, with mild massage, electric hand, local, to prevent atrophy, 5-10 min., daily. S. s., or roller, to spine, and muscles, 15 min., daily, or e. o. d., p. r. n. Bennett head magnetone, 30-40 min., daily. Magnetic wave bath.

HYSTERICAL: (See Hysteria.) G. g., g. f., c. g. S. ind., s. s., s. roller, to spine and muscles. S. shower. S. ins., 15-20 min., daily. In women, correct uterine troubles. (See Displacements.) Body magnetone. Magnetic wave bath.

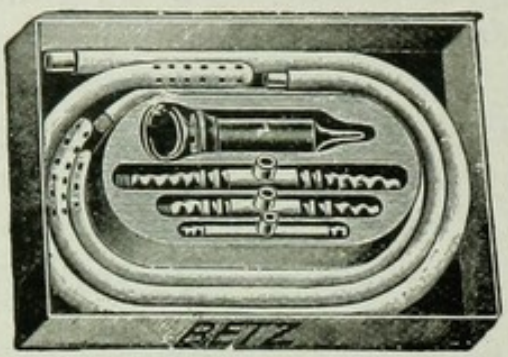
INFANTILE: C. con., lab., — over affected areas, + opp., 5-10 ma. 10-15 min., daily. G. g., c. g. F. sec., (coarse coil). Electric hand



massage. (See Massage.) Place child in s. cage or Bennett magnetone, 30-40 min., daily. H. f. H. f. fine sparks, body vac. elect., p. r. n. Magnetic wave bath.

INTESTINAL: G. int., lab., + abd., roller, or sponge elect., — back

or rectum, stab., 10-15 ma., 10-15 min., daily. Move abd. elect. along course of colon, and downward. Slow int., 60 per min. F. prim., or sec. (coarse coil), or sin., or s. ind., same way.



Johnson's electric irrigating outfit with syringe and tubes for rectal, bladder and vaginal work.

Hydro-Electric Rectal Injections: (See Impaction) in knee-chest posture, — rectum, with long colon tube elect. (See cut above), + abd., or back, with bowel full of normal salt sol. S. vib., Bennett method, + abd., — back, 5-10 min., daily.

Lead: G. con., hydro-electric, and vapor-electro baths, to favor active elimination. (See Hyperæsthesia of Skin, Rheumatism, Gout.)

Ocular Muscles: G. con., — hydo-electric cup, or wet sponge, over eye, + nucha, 3-5 ma., 5-10 min., daily. F. sec. (long fine coil), mild, same way. S. ind., same way. S. spray, local, over eye. S. s., short, to temples and neck, 3 min., daily. S. vib., Bennett method, + to eye, with soft sponge elect., — nucha, or crown, 5 min., daily.

Œsophagus: G. int., — lab., to throat, external, + nucha, stab., 5-10 ma., 5-10 min., daily. F. prim., same way. Electric hand massage, same.

Paraplegia: (See Brain Troubles, Hemiplegia, Ataxia, Sclerosis.)

Peripheral, Facial: (See Facial Paralysis.)

Pelvic Diseases, Inflammations, Exudates, Adhesions (See Metritis, Sub-Involution, Displacements)

G. con., — vag., + abd., Bennett disc, 20-60 ma., 10-20 min., e. o. d. G. con., + abd., — back. (See Amenorrhœa.) H. f. vag. vac. elect., 15 min., e. o. d. Magnetic wave bath.

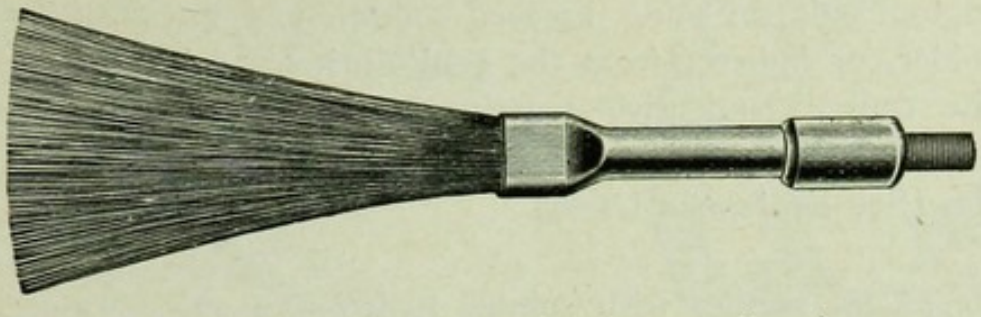
Pelvic Peritonitis, Chronic (See Appendicitis)

Treatment same as above.

Penis, Non-Development (See Atrophy, Bust Development)

G. con., — to penil developer (see cut), + back. Mod. vac., 5-10 ma., 5-10 min., daily. G. con., to mug elect., (See Orchitis), + back, 5-10 ma., 5-10 min., daily. F. sec., same way. S. vib., Bennett

method, — to penis, + back, 10 min., daily. (See Spermatorrhœa, Neurasthenia, Sexual.) H. f. penis, vac. elect.



Penis, Glans, Anæsthesia (See Anæsthesia, to relieve)

F. sec., locally to glans with wire scourge, p. r. n. (See cut.)

Phlebitis

Leg magnetone.

H. f. body vac. elect. mild, p. r. n.

Pigmentation (See Blemishes, Nævus, Powder Marks)

Piles (See Hemorrhoids)

Pleurisy

G. Con., + to pain, — distant; or from front to back, 5-10 ma., 10-15 min., daily. Helios violet light, to side, 15 min., daily. H. f. body vac. through clothing till skin reddens, p. r. n.

Podalgia

G. con., + heel, — hands, 10-20 ma., 10-20 min., daily. S. surge. or S. vib., Bennett method. + foot, — back, or crown, 15 min., daily. Look for soreness in sacral spine.

Polio-Myelitis (See Myelitis)

Post Fracture Conditions

Post Operative Conditions

H. f. body vac. elect., 10 min. daily, auto pad., p. r. n.

Post-Partum Hemorrhage (See Hemorrhage, Menorrhagia, Obstetrics, Uterine Inertia)

Powder Marks, Removal (See Blemishes)

G. con., — Bennett needle holder, or Nævus elect. (See Nævus), 5-10 ma., 5-10 min., wkly. (See lesson 25, page 28.)

Pregnancy, Extra-Uterine, Tubal (See Gestation, Ectopic)

Pregnancy, Vomiting

G. con., + in fossa under left ear, — top sternum, stab., or over stomach, 5-10 ma., 10-20 min., p. r. n. Or + over stomach — back, 10-15 ma., 15-20 min., p. r. n. daily. Magnetic wave bath.

Prevention of X-Ray Burns (See Burns, X-ray, to prevent)

Priapism

A symptom only, of some diseased condition of the urethra, prostate, or bladder, or indirect from the genito-urinary spinal center. "Find out the cause," and give sedative electric treatments, central and peripheral.

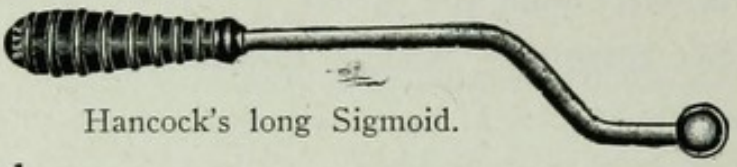
Procidentia (See Prolapsus Uteri)

Proctitis

G. con., + in rectum with soluble hydro-elect., No. 3 tip, — back, 5-10 ma., 10-15 min., daily, for the phoric interstitial copper effect. H. f. rectal vac. elect., 10 min. daily.

Prognosis in Peripheral Paralysis (See section two)

Progressive Muscular Atrophy (See Atrophy, Muscular)



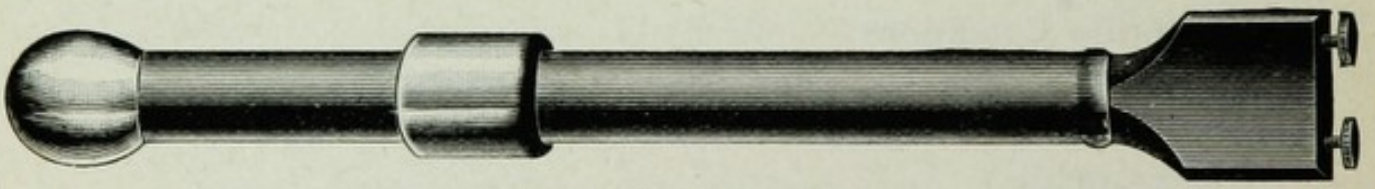
Hancock's long Sigmoid.

Prolapsus, Rectal

Sin., or f. prim., or f. sec. (coarse coil), or g. int., slow. Bipolar elect., in rectum, or single pole in rectum, other abd. Mode strong enough to cause muscular contraction, 5-10 min., daily. Soluble hydro-electric douche, No. 3 tip. H. f. mild spark to cause retraction. Then rect. vac. elect., 10 min. daily.

Prolapsus Uteri (See Amenorrœa)

G. int., — int.-ut., + back, or abd., Bennett disc, slow int., 10-20 ma., 10-20 min., e. o. d. F. prim., and s. ind., same way. H. f. vag. vac. elect., 10 min. daily.



Goelet's Bipolar, plated or copper.

Prostate Gland, Enlargement

G. con., — prostatic phoric elect., flexible copper wire covered with cotton, wet with sat. sol. potass. iod., inside tube, in urethra, or rectum, + back, 5-8 ma., 5-8 min., e. o. d., or wkly., p. r. n. G. con., + in rectum, opp. gland, — sponge pad on perinæum, 5-10 ma., 10-20 min., e. o. d. X-ray, to perinæum. Bidet chair. S. vib., Bennett method, — perinæum, + back, 5-15 min., daily. H. f. rect. vac. elect., 10 min. daily, p. r. n.

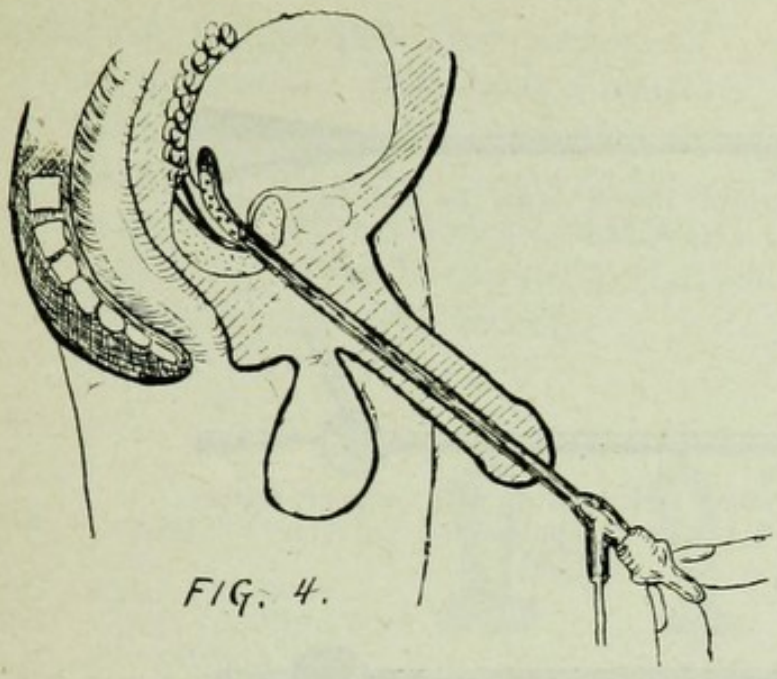


FIG. 4.

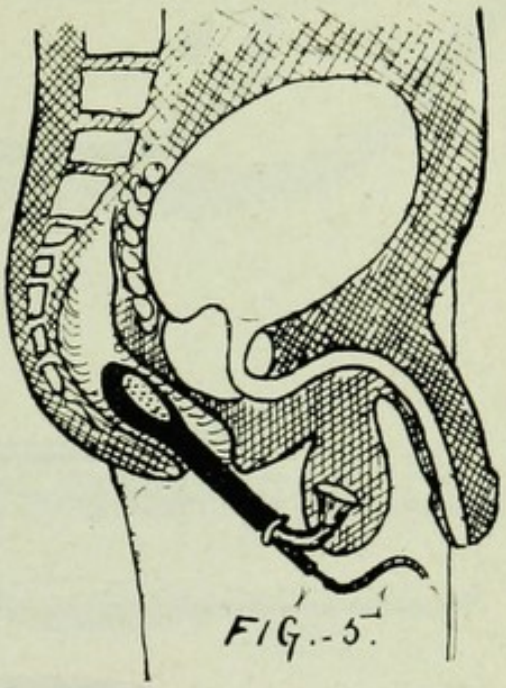


FIG. 5.



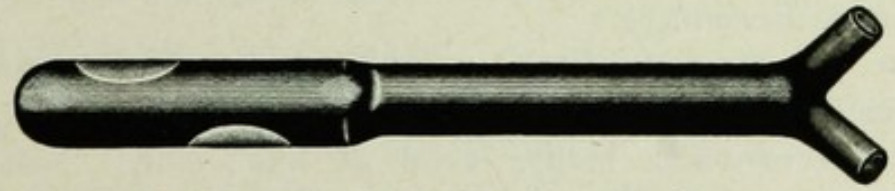
Prostatic phoric electrode in bladder.



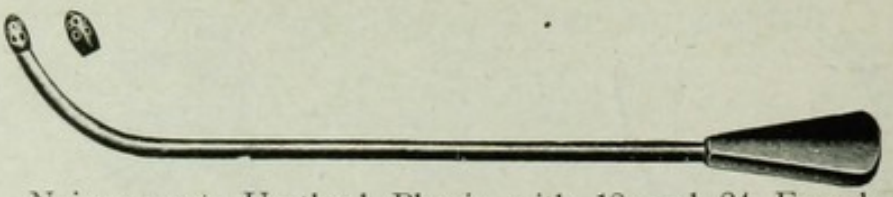
Prostatic phoric electrode in rectum.



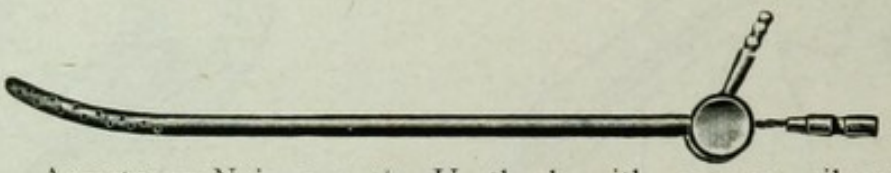
Bowen's Prostatic.



Overall's Bipolar, Vaginal and Prostatic copper contacts. Hard rubber is vulcanized on the copper contacts and are absolutely perfect.



Neiswanger's Urethral Phoric with 18 and 24 French Olives.



Armstrong-Neiswanger's Urethral with copper, silver and zinc wire applicators.



Neiswanger's Phoric, copper center, with outlet on all sides.

Prostate Gland, Granular (See Gonorrhœa, Gleet)

Treatment same as above, but with copper wire only, in phoric elect., wet with normal salt sol. G. con., + with hydro-electric soluble set.

Prostatitis, Inflammatory (See Inflammation, Prostate, Enlarged)

Proud Flesh (See Ulcer, Lupus)

Pruritis (See Eczema)

G. con., + to lesion, lab., — opp., stab., 5-10 ma., 5-10 min., daily. F. sec. (long fine coil), or sin., same way. S. spray, local, 10 min., daily. Magnetic wave bath. Magnetones.

PUDENDAL: Bidet chair bath, violet light. X-ray, soft tube, short treatments, daily. Protect surrounding parts, with Allen shield. H. f., surface vac., elect., local, daily.

Pseudo-Leukemia (See Leukemia)

Psoriasis (See Eczema)

G. con., + Bennett phoric, with witch hazel, or antiseptics, local, 5-10 ma., 5-10 min., daily. Russian or helios violet light, 15 min., daily. Electro-vapor baths. Ozol, 30 min., daily. X-ray, soft tube, mild radiations, to slight erythema only, required to relieve the itching. H. f., surface vac., elect., local, daily.

Pterygium (See Eye Diseases; Pterygium)

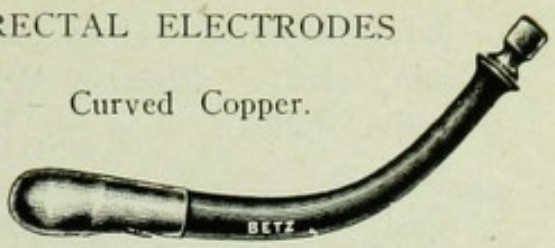
QUINSY (See Tonsils)

RECTAL DISEASES (See Erosions)

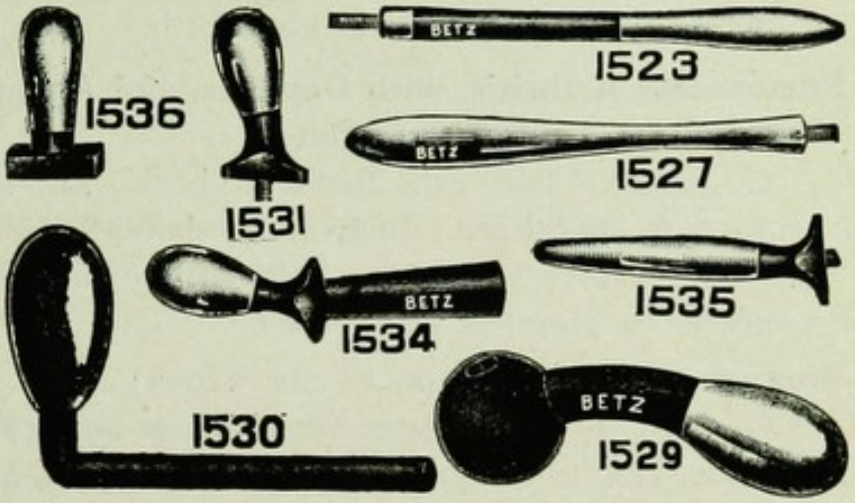
ANAL FISSURE: (See Anus, Fissure).
INFLAMMATION: (See Proctitis).
HEMORRHOIDS: (See Hemorrhoids).
PARALYSIS: (See Paralysis, Intestinal).
PROLAPSUS: (See Prolapsus, Rectal, and Uterine).
STRICTURE: (See Stricture).
ULCER: (See Ulcer).

RECTAL ELECTRODES

Curved Copper.



1523. Copper, Straight, long.
1527. Same, all metal.
1529. Knagg's Long Curved, Copper.
1530. Rice's new, Copper.
1531. Neiswanger's Copper.
1534. Steele's Copper with handle.
1535. Van Snyder's long, Copper.
1536. Same, short, Copper.



Reaction or Degeneration (See section two)

Reaction, Normal Muscle (See section two)

Respiration, Artificial, to induce (See cut, section two)

F. sec., one elect. just above collar bone, at bottom or sterno-cleido-mastoid muscle, on right side (as shown at A), other pole below end of sternum (as shown at E), or along costal cartilages, on left side. Make and break circuits by raising and lowering either pole, 10-15 times per min., continue p. r. n.

Retained Placenta (See Abortion, Hemorrhage, Post-Partum, Obstetrics)

Retro-Flexion (See Displacements)

Retro-Version (See Displacements)

Rheumatism, Articular (See Sprains)

Acute: G. con., + to joint., or lab., — opp., 10-20 ma., 10-20 min., daily. If very painful: — distant. S. spray, 5-10 min., local, daily. H. f. mild. Auto-pad., p. r. n. Magnetones.

CHRONIC: G. con., — cat., stab., or lab., to joint, Bennett phoric, lithia or soda salts, + opp., 10-15 ma., 10-15 min., daily. Electric

hand massage. (See Massage.) S. s. Bennett magnetone, 10-15 min., daily. Electric light baths, general or local. Electro-vapor baths, daily or e. o. d., p. r. n. Helios violet light, 15 min., daily. H. f., surface, vac. elect. Auto condensation.

GOUTY: (See Gout.) Magnetones.

GONORRHŒAL: (See Gonorrhœal Rheumatism).

Rheumatism, Muscular (See Lumbago)

G. con., + electric hand massage, or g. con., + lab., to muscles, — distant, 10-20 ma., 10-20 min., daily. S. s. S. roller, to muscles. S. ins., 10 min., daily. Use all the methods, same as in articular form, above, p. r. n. Magnetic wave bath.

Rheumatoid Arthritis, with Deposits, and Anchylosis (See Arthritis Deformans, Anchylosis, Gout)

G. con., — lab., cat., Bennett phoric, sat. sol. potass. iod., to joints, + opp., 15-20 ma., 10-15 min., daily. S. s. Electric hand massage. H. f., surface vac. elect. (See all treatments for rheumatism.) Magnetones. Magnetic wave bath.

Ringworm (See Eczema, Favus, Tinea)

G. con., + ana., copper or zinc tip, amalgamated, or plain, wet with brine, lab., to lesion, — distant, till there is a green color. If on head: 3-4 ma.; if on body: 10-20 ma., 2-5 min., e. o. d. Finsen light, local. X-ray, local, soft tube. Helios violet light, 15 min., daily. H. f. surface vac., elect.

SALPINGITIS (See Appendicitis, Inflammation, Ovaritis, Pelvic Disease)

G. con., + vag., carbon elect., — sacrum, 10-20 ma., 10-20 min., e. o. d., G. con., + abd., Bennett disc, — black (See cut, Amenorrhœa), stab., 10-20 ma., 20-30 min., daily.

Sarcoma (See Carcinoma, Epithelioma, Lupus, Moles)

G. con., — needles under base, + near (See cut page 172), 10-20 ma., 10-20 min., e. o. d. Massey method of massive zinc-mercury interstitial diffusion is best. (See lesson No. 29, page 3.)

Seminal Emissions (See Emissions, Seminal, Spermatorrhœa)

Sequelæ to Acute Diseases (See Marasmus)

Give general tonic, sedative or stimulating treatments, p. r. n., as indicated, to stimulate tissue metabolism, catalysis, and restore electro-magneto-tonus.

Scales in Colon (See Constipation)

Scars (See Cicatrix, Contractions, Nævus)

Sciatica (See Brachial Neuritis)

G. con., + stab., to sacrum or hip, — feet, 10-15 ma., 10-20 min., daily. S. s., mild to nerve and spine. S. spray, local to pain, 10 min., daily. S. ins., 15 min., daily. Helios violet light, 15 min., daily. Electro-vapor baths, daily. H. f. body vac. elect. Auto-pad, 10 min., daily. Magnetic wave bath.

Scirrhus (See Carcinoma)

Sclerosis (See Lateral Sclerosis, Paralysis)

Sexual Neurasthenia (See Neurasthenia, Sexual)

Shingles (See Herpes Zoster)

Shock, Surgical, to prevent

Apply Bennett body magnetones and magnetic wave bath for 2 hrs., before, all during, and 2 hrs., after the operation. Has invariably prevented shock or pyrexia, and sustains animation, requiring less anæsthetic.

Singultus (See Hiccough, Spasm of Diaphragm)

Sleeplessness (See Insomnia)

Small Growths (See Blemishes, Epithelioma, Moles, Nævus, Warts)

Softening, Cerebral (See Apoplexy, Aphasia, Brain Troubles, Hemorrhage, Cerebral)

G. con., not till after 3rd wk., + over site of pain, long., trans., diag., p. r. n., to influence tissue metabolism and promote normal circulation and absorption of clot; + to relieve pain, check hemorrhage, harden and contract tissues, — to dilate, absorb, and relieve pressure. Bennett head magnetone, 20-50 min., daily. Magnetic wave bath.

Spasm, Bladder (See Bladder Irritable, Cystitis)

G. con., + over pubes, — sacrum, 10-20 min., daily.

Spasm, Facial (See Neuralgia, Trigeminal)

G. con., + above or in front of ear, — nucha, 3-6 ma., 5-10 min., daily. S. spray, 5-10 min., daily. S. shower, 15 min., daily. H. f., surface vac. elect., local, 5-10 min., daily. Bennett head magnetone, 20-30 min., daily. Auto-pad, 15 min., daily.

Spasm of Diaphragm (See Hiccough)

G. con., + fossa below left ear, — top sternum, or over stomach, 5-10 ma., 5-10 min., repeat, p. r. n. G. con., + over stomach, — between shoulders, on back, or nucha, 10-20 ma., 10-20 min., p. r. n.

Body magnetone and magnetic wave bath, 10-30 min. F. sec. (long fine coil), lab., stomach to back, 5-10 min., every 3-4 hours. Sin., same way. Auto-pad, 15 min., daily.

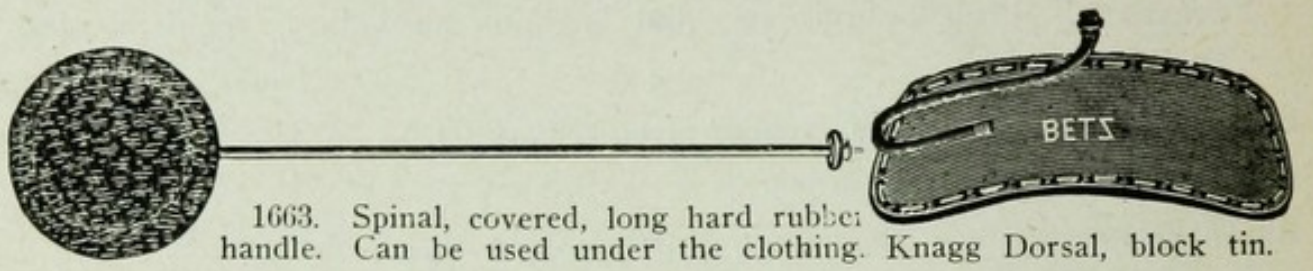
Spasm, Sterno-Cleido-Mastoid (See Torticollis)

Spermatorrhœa (See Hemorrhoids, Prostate, Orchitis, Varicocele)

G. con., + rectum, — abd., Bennett disc, 5-10 ma., 5-15 min., daily, or e. o. d. G. con., + perineum, — feet. G. con., + spine, — feet, 10-15 ma., 10-15 min., daily. S. vib., Bennett method, + perineum, — nucha, sacrum, or crown, 10-15 min., daily. F. sec. (long, fine coil), or sin., mug water elect., to back, 10-15 min., daily. H. f. rect. vac. elect., 10 min., daily. Auto-pad, 10 min., daily.

Spinal Meningitis, Chronic

G. con., + nucha, stab., — down spine, stab., or lab., 5-10 min., daily. Helios violet light, to spine, 15 min., daily. Body magnetone, 30 min., daily. Auto-pad., 15 min., daily. Magnetic wave bath.



1663. Spinal, covered, long hard rubber handle. Can be used under the clothing. Knagg Dorsal, block tin.

Spleen, Enlarged (See Leukemia)

G. con., — over spleen, lab., deep massage, electric hand, sponge pad, or roller, + sacrum, 10-15 ma., 10-15 min., daily. F. sec., (long fine coil), or sin., or s. ind., same way. X-ray (See Leukemia). Ozol, 30-40 min., daily. Body magnetone. Magnetic wave bath.

Sprains (See Arthritis)

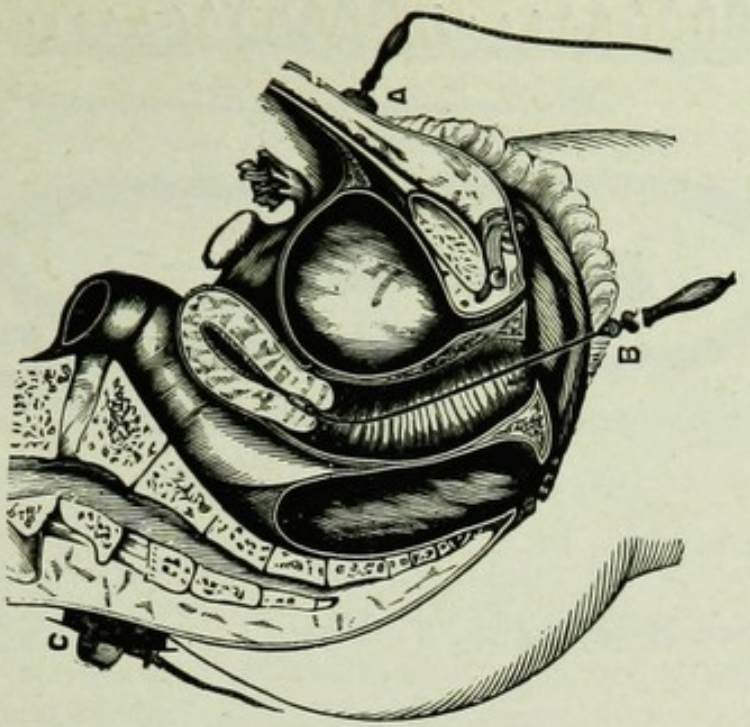
G. con., + stab., or lab., to lesion, — distant 5-10 ma., 10-15 min., daily. Bennett magnetone, 15-30 min., daily. Helios violet light, 15 min., daily. H. f. body low vac. elect., 20 min., t. i. d., p. r. n.

Stammering (See Aphasia, Aphonia, Brain Troubles)

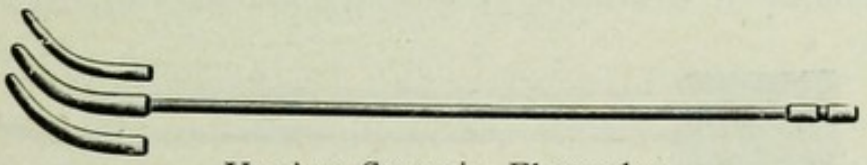
G. con., to brain, long., trans., diag., p. r. n. Through neck and larynx. S. ins., and s. shower, 15 min., daily. Bennett head magnetone, 20-30 min., daily. H. f. body vac., 10 min., daily. Auto-pad, 10 min., daily. Magnetic wave bath.

Stenosis, Uterine (See Dysmenorrhœa, Stricture)

G. con., — tapering tips (see cut), int.-ut., + abd., Bennett disc, 20-40 ma., 15-20 min., e. o. d., or wkly., using successively larger tips.



Treatment of Uterine Stenosis.



Uterine Stenosis Electrodes.

Sterility

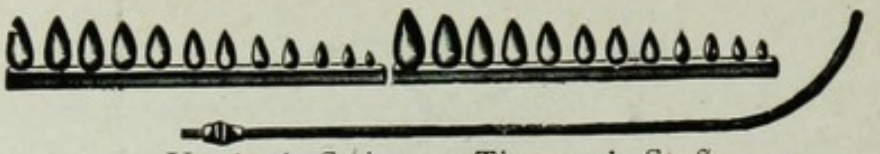
MALE: (See Obesity, Orchitis), "Find out the cause," and remove it if possible. Treat p. r. n., any acute inflammatory process, or sequelæ, or remote functional trouble. Give tonic, sedative or stimulating applications, as indicated, both peripheral and central. H. f. rect. or ureth. or penis vac. elect., p. r. n. Auto-pad.

FEMALE: (See Amenorrhœa, Obesity, Metritis, Stenosis, Sub-Involution.) If due to venereal infection, treat endometrium with g. con., copper tip, + int.-ut., — abd., Bennett disc, 5-15 ma., 5-10 min., e. o. d., to get interstitial metallic diffusion. H. f. vag.

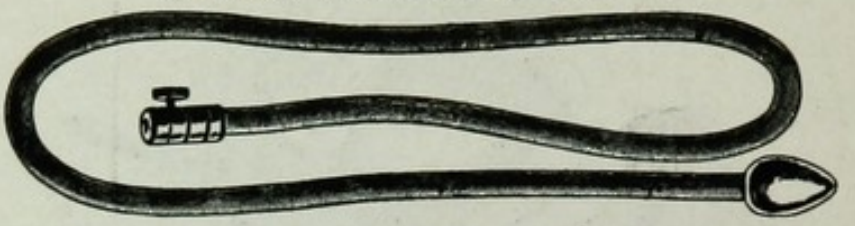
INFANTILE UTERUS: (See Atrophy, Displacements.) G. con., — vag., or int.-ut., + abd., Bennett disc, 10-20 ma., 10-20 min., e. o. d. G. int., or f. sec. (coarse coil), or sin., same way. F. sec., bipolar, int.-ut., 5-10 min., daily. Magnetic wave bath.

Stiff Joints (See Anchylosis)

Stomach, Atony of (See Atony of Stomach)



Urethral Stricture Tips and Staff.



Œsophageal Stricture Electrode.

Stricture

EUSTACHIAN:

LACHRYMAL:

NASAL: (See Hypertrophy, Turbinate.)

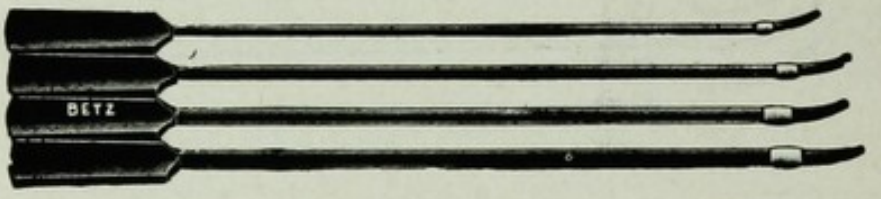
ŒSOPHAGEAL:

URETHRAL:

UTERINE:

VAGINAL:

The technique of treatment of stricture is practically the same in any



Richardson's Set, for dissolving stricture by galvanic mode.

canal, the only difference being in the size or shape of the active electrode, the mode strength, and duration and frequency of applications, governed in each case by the location, extent, size, number and character, and idiosyncrasy of the patient. The plan is to learn the caliber of the stricture, then to use a tip a size larger, so as to put tension on the tissues, thus insuring perfect contact, which facilitates electrolysis, by which process the stricture is dissolved and removed. USE ONLY GALVANIC MODE, attached to the bare metal tip, on an insulated staff, in the canal (see cuts). This is attached to THE NEGATIVE POLE ONLY. Introduce elect., till it strikes stricture, + distant. TURN ON CURRENT SLOWLY, till distinctly, but NOT PAINFULLY FELT by patient (DO NOT USE COCAINE), 2-6 ma., in urethra, 5-20 in rectum. USE GENTLE PRESSURE ONLY, and WAIT till tip passes through

the band, which takes from 2-20 min. Remove same way, till again passed band. Turn off mode, and remove. Do not use another size tip the same day. Repeat in 3-10 days and continue, each time with the same or a size larger tip, till THE STRICTURE IS REMOVED. When poperly treated this way, it is not stretched, torn, bruised, cut or made worse, but is slowly and surely dissolved, and removed forever. (See page 170.)



Apostoli's Bipolar, Cataphoric.

Sub-Involution, Uterine (See Displacements)

F. sec. (coarse coil), slow int., bipolar elect., int.-ut., or one pole abd., Bennett disc, other in rectum (see cut, opp. page 32), 15-20 min., daily, swelling mode. S. ind., or sin., same way. G. con., — int.-ut., + Bennett disc, 20-40 ma., 15-30 min., e. o. d., or wkly. G. int., same way, 5-10 min. H. f. vag. and uterine vac. elect., 10 min., e. o. d.

Superfluous Hairs (See Hairs, Superfluous)

Supra-Orbital Neuralgia (See Migraine, Neuralgia)

Sweating of Axillæ and Feet (See Hyperidrosis)

Swelling Currents (See page 160)

Sycosis (See Eczema, Favus, Ringworm)

X-ray almost a specific. Treat same as for above. H. f. mild. Ful.

Syncope (See Brain Troubles, Anæmia)

Synovitis (See Arthritis, Inflammation, Rheumatism, Sprains)

G. con., + to part, — distant, 5-10 ma., 10-15 min., daily. Local, electric light bath. Helios violet light, 15 min., daily. Bennett magnetone, 20-30 min., daily. H. f. body vac. elect., 10 min., daily. Magnetic wave bath.

Syphillis, Chancre (See Chancroids, Ulcer, Warts)

GENERAL: Electro-vapor baths, daily, or e. o. d. Electric light bath. Ozol, 30-60 min., daily. This treatment has produced clinical results, and symptomatic cures, in from 3-6 mos. that would require 3-4 yrs. with ordinary drug medication.

CEREBRAL: G. con., + to forehead, large pad. — nucha, 2-4 ma., 5-10 min., daily. Bennett head magnetone, 20-30 min., daily. In addition to the foregoing.

TABES DORSALIS (See Tuberculosis, Spinal)

G. con., + nucha, — sacrum, 10-20 ma., 10-20 min., daily. Ozol, 30-60 min., daily. Magnetic wave bath.

Tattoo (See Blemishes, Powder Marks)

Tetanus

G. con., + to affected muscles, lab., or stab., electric hand massage, hand pad, or roller elect., — distant, mild, 2-10 ma., 5-15 min., repeated, p. r. n. C. g. Bennett head magnetone, 15-30 min., daily. Helios, Russian or Minin violet light, locally to spine, or generally, p. r. n. Ozol, 30-40 min., daily. Magnetic wave bath.

Tic Doloreaux (See Neuralgia Trigeminal, Spasm Facial, Pain)

Tinea Circinata (See Ringworm)

Tinnitus Aurium (See Deafness)

Telephone Ear (See Deafness)



Copper Tonsil Spoon.

Tonsils, Enlarged (See Glands, Enlarged)

G. con., + platinum or gold spear in tonsil, — in hand, 5-10 ma., (cocaine), 2-5 min., e. o. d., or wkly., p. r. n. G. con., + ana., cup shaped copper elect., on an insulated stem, to surface, — in hand, lab., to prevent sticking, till green color, 5-10 ma., 5-10 min., daily, or e. o. d. G. con., — steel needles, in glands. + hand, 2-5 ma., 3-6 min., daily. Galvano-cautery point or knife, to gland. Ful. H. f. vac. local.

Tonsils, Folliculitis (See Ulcer)

G. con., — needles in follicles; or g. con., ana., + copper needle, lab., in follicles, — hand, 2-6 ma., 2-3 min., daily. H. f. body elect., 10 min.

Toothache, Neuralgic (See Neuralgia, Pain)

S. spray, local, + to pain, — crown, 10-15 min. S. ins., 20 min., daily. G. con., + sponge pad over nerve, — nucha, lab., or stab., 2-5 ma., 5-10 min. G. con., + platinum wire, wrapped with cotton, wet in strong sol. cocaine, in cavity, — in hand, 1-3 ma., 5-10 min. H. f., surface vac. elect., local, 5-10 min. Helios or Minin violet light, 15 min. Bennett head magnetone, 15-20 min. H. f. body vac. elect., 10 min., p. r. n. Magnetic wave bath.

Torticollis

F. sec. (coarse coil), slow int., 5-10 min., lab., to muscles of opp. side, daily. G. con., + pad, to weaker muscles. S. ins., 15 min., daily. G. con., electric hand massage, 15 min., daily. C. g., H. f. body vac. to neck and spine, 10 min., t. i. d., p. r. n.

Toxæmia (See Constipation, Marasmus)

Electro-vapor baths. Electric light baths. Ozol, 20-40 min., daily.

Trachoma (See Eye Diseases, Trachoma)

Tubal Pregnancy (See Gestation, Ectopic)

Trichiasis (See Hairs, Superfluous)

Tuberculosis (See Marasmus, Debility, Fever Convalescence)

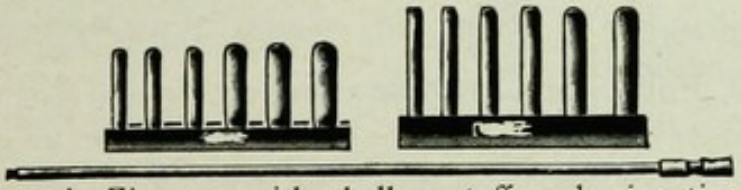
G. g., g. f., c. g. Electro-vapor baths. S. ins., s. spray, s. shower. Ozol, 30-40 min., daily. Electric light baths. Helios violet light, 15 min., daily. Diasolenic zone, and s. cage. Body magnetone. Magnetic wave bath.

Tuberculosis

ARTICULAR: (See Tuberculous Glands, Arthritis, Synovitis)
CUTANEOUS: (See Lupus)
INTESTINAL: (See Tabes, Diarrhœa, Constipation, Pain)
PULMONARY: (See Consumption)
SPINAL: (See Tabes Dorsalis, Spinal Meningitis)
TESTICULAR: (See Glands Enlarged, Tuberculous Glands)

Tuberculous Glands (See Carcinoma)

G. con., ana., + Bennett phoric, cocaine, 5-10 min.; or Russian, Minin, or helios violet light, 15-30 min., till anæsthetized. Then cut



Massey's Zinc set with shellac staff and zinc tips, for Anaphoresis.

skin over gland, and incise down to gland, if possible. Then apply g. con., — distant, + to silver of zinc, or elect., amalgamated, lab., to keep wound open for drainage. Then insert a gold tip, insulated

and amalgamated, as deep in the wound or sinus as can be. Apply g. con., + to point, 2-10 ma., 10-15 min., or till mercury is deposited by interstitial diffusion, e. o. d., till cured. Dress with cotton, dioxygen and ungt. $Hg.O_2$. Ozol, 30-40 min., daily. This combination gives best results with minimal scarring. (See lesson No. 30.)

Tumors (See Blemishes, Growths, Moles, Warts)

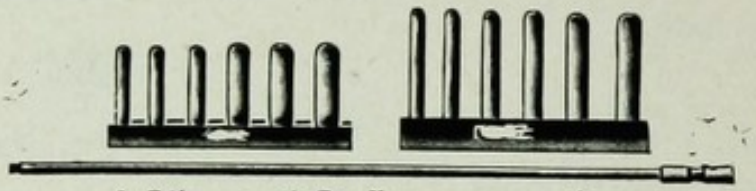
BENIGN: G. con., — over growth, + opp., 10-30 ma., 10-20 min., e. o. d. G. con., — Bennett needle holder, with from 1-10 needles, according to size of base, + distant. Remove and re-insert, as before, at right angles to 1st insertion, and repeat, 5-20 ma., 10-20 min. One treatment usually enough. H. f., Ful.

FIBROID: (See Fibroids Uterine, Warts).

MALIGNANT: (See Carcinoma).

VASCULAR: (See Nævus, Varicose Veins).

ULCER, CORNEAL (See Eye Diseases, Corneal Ulcer)



6 Olives and Staff, copper or zinc.

Ulcer, Exuberant, Fungus, Indolent, Phagedenic, Rodent, Sloughing, Syphillitic, Varicose (See Carcinoma, Lupus, Syphillis)

G. con., ana., copper or zinc elect., plain or amalgamated, + to surface or into ulcer, lab., — near, stab., 5-20 ma., 5-15 min. (cocaine), e. o. d. till get green (copper), or white (mercury), deposit, by interstitial diffusion. S. spray. S. s., to ulcer. X-ray, soft tube, short, and often, p. r. n., till gray exudate appears, then less frequent, till well. Follow with Minin or helios violet light, 15 min., daily. Protect healthy skin against burn by Allen shield. Ozol, 20-40 min., daily, to oxidize blood. Splendid, especially in syphillis, H. f., Ful.

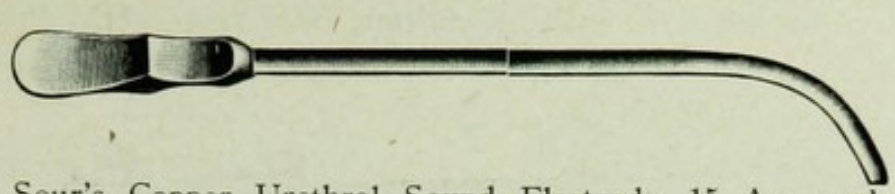
Urethra, Female, Polyp, or Caruncle (See Growths, Moles, Warts)

G. con., cautery point, local. G. con., — needle in growth, + abd., Bennett disc., 2-10 ma., 2-4 min. G. con., ana., + copper needle in growth, — abd., 2-5 ma., 2-4 min., p. r. n. Usually one treatment enough. Ful.

Urethra, Hyperæsthesia (See Pain, Functional Nervous Diseases)

F. sec. (fine coil), or sin., to cold bare steel sound entire length of urethra, other pole, back, mild dose, 5-10 min., daily. G. con., —

same way as above, + back, 2-5 ma., 5-10 min., daily. Hydro-electric injection, soluble set elects. Bidet chair, violet light, local, 15 min., daily. H. f., ureth. vac. elect., 5 min., daily., p. r. n. Auto-pad.



Sour's Copper Urethral Sound Electrode, 15 Am. scale

Urethra, Stricture (See Stricture)

Urethritis (See Gleet)

Urine, Incontinence (See Bladder Irritable, Spasm, Incontinence of Urine)

F. sec. (fine coil), or sin., one pole in rectum, urethra or on pubes, other pad, on perineum. Mild swelling application, 5-15 min., daily. G. con., + pubes, — sacrum, or perineum; or + sacrum, — feet, 10-20 ma., 10-15 min., daily. S. s., spine. S. ins., 20 min., daily. H. f., body vac. elect.

Urticaria (See Hives, Pruritis)

Uterine Derangements

ATROPHY: (See Atrophy).

F. prim., or sec. (coarse coil), or sin., or s. ind., or g. int., or g. alt., slow, — int.-ut., + abd., Bennett disc, or sacrum. (See cut, Amenorrhœa, page 21), 10-30 ma., 10-20 min., e. o. d.

CANCER: (See Carcinoma).

DISPLACEMENTS: (See Displacements, Prolapsus, Sub-Involution).

FIBROIDS: (See Fibroids, Uterine).

INERTIA: (See Hemorrhage, Post-Partum, Obstetrics, Sub-Involution).

Uterus, Infantile (See Sterility, Infantile Uterus, Uterine Atrophy)



Hard rubber and nickel plated.



Hard rubber and nickel plated or copper.

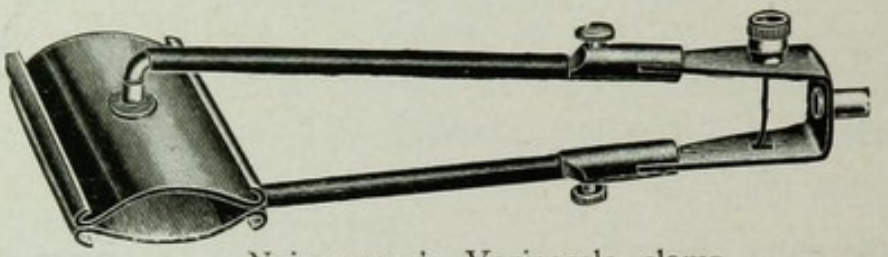
VAGINAL ELECTRODES

VAGINAL LEUCORRHOEA (See Endo-Metritis, Leucorrhœa)

Vaginismus (See Stricture, Vaginal)

F. sec. (fine coil), or sin., vag., and abd., Bennett disc (See cut, Amenorrhœa, page 21) mod. dose, 10-20 min., daily. G. con., +

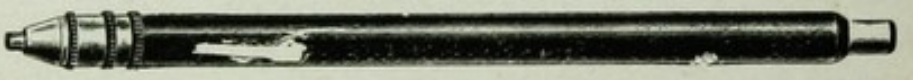
aluminum or carbon elect., vag., — abd., 5-20 ma., 10-20 min., daily. H. f., vag. vac. elect. (No. 2), vag. S. vib., Bennett method, same way, + vag., — abd., Bennett disc., mild vib., 5-10 min., daily. Put sphincter on tension, with speculum, or large rectal olive tip elect., attached to f. sec. (long fine coil), or sin., 5-10 min., daily.



Neiswanger's Varicocele clamp

Varicocele (See Varicose Veins, Orchitis)

G. con., + to scrotum, — abd., or back, ana., + Bennett phoric, wet with adrenalin, cocaine, thuja, hammemelis, held firmly against varix, 5-10 ma., 5-10 min., daily. G. con., ana., + mug, water bath elect., as in orchitis, filled with above drug solutions, in which is immersed the scrotum, 5-10 min., daily, G. con., ana., + with divided varix clamp elect. (see cut), plates covered with cotton, wet with above drugs, clamped closely on both sides varix, 5-10 ma., 5-10 min., daily. Continue, p. r. n.



Needle Holder

Varicose Veins (See Aneurism, Nævus)

G. con., + platinum or gold needle in vein, insulated except tip, — near, 5-10 ma., 5-10 min., or till clot forms. G. con., ana., + copper needle, same way. Reverse polarity, 1-3 min., to loosen needle. G. con., ana., + Bennett phoric, with cocaine, adrenalin, thuja, or hammemelis, stab., with pressure, 5-10 ma., 5-10 min., daily. If painful, Minin or helios violet light, 15 min., daily.

Vascular Tumors (See Aneurism, Nævus, Varicose Veins)

Verruca (See Warts)

Versions, Uterine (See Displacements)

Vertigo (See Brain Troubles)

Virginal Amenorrhœa (See Amenorrhœa, Chlorosis)

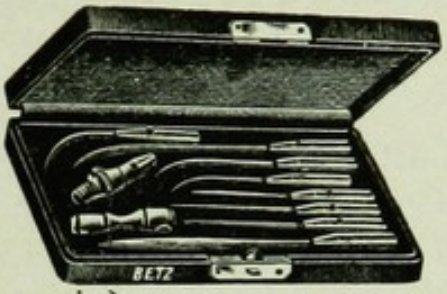
Virginal Dysmenorrhœa (See Dysmenorrhœa)

WARTS (See Blemishes, Epithelioma, Growths, Moles)

G. con., — needles in base, + near, 3-10 ma., 5-10 min., once. S. s., to growth. H. f., vac. surface elect. Apply chromethylate sodium, local. Ful.

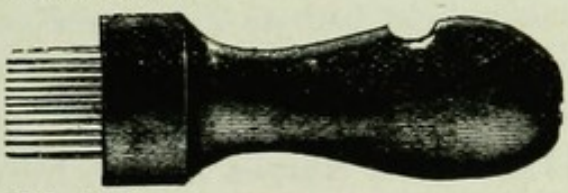
NEEDLE OUTFIT

Has straight and curved gold plated needles, with attachments, in fancy case.



Wakefulness (See Brain Troubles, Insomnia)

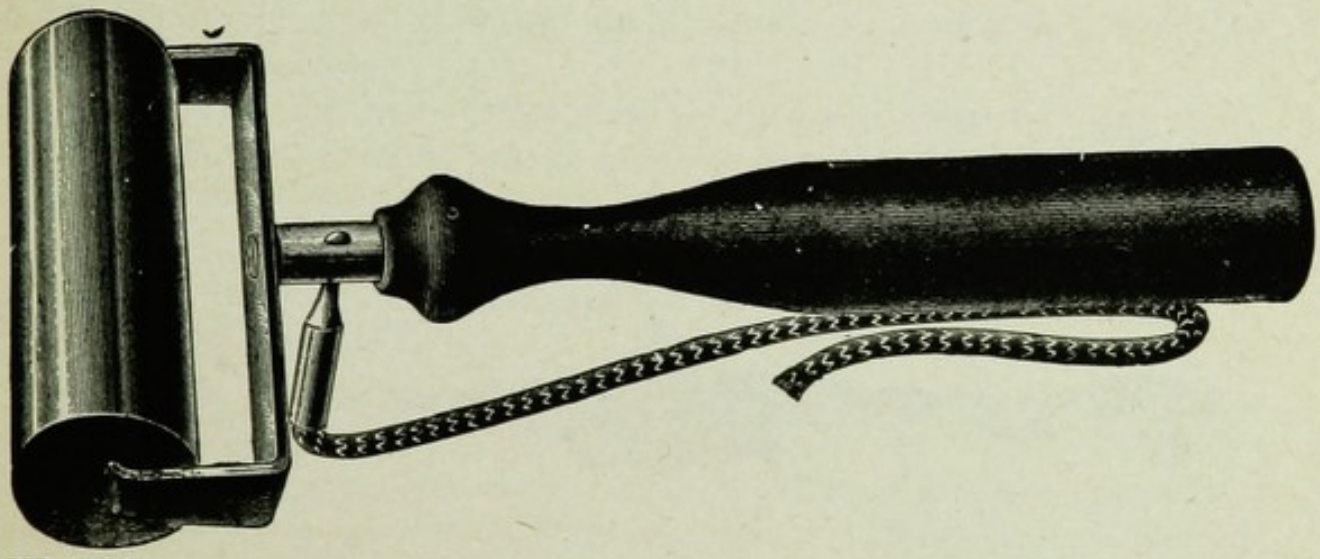
Needle Disc for removing Pigmentary nævus or wine marks.



Wine Marks (See Blemishes, Nævus, Moles)

Wounds (See Ulcer)

Suppurative wounds best treated as old ulcers, with interstitial metallic diffusion, and helios violet light, 15-20 min., daily.



Wrinkles

G. con., — sponge, hand pad, or roller elect. (see cut), electric hand massage, making strokes lengthways of the folds, skin wet, roller covered with felt, wet, mild doses, 2-4 ma., 10-15 min., daily.

Writers' Cramp

S. vib., Bennett method, + in affected hand, — other hand, spine, or crown elect., mild vib., 10-15 min., daily. Several hours' or days' rest, during treatment is best, or change of work. G. con., + lab., to affected hand, — opp. hand, 5-10 ma., 10-15 min., once or twice daily. + in palm, if fingers extend, + on back of hand, if fingers

are flexed. G. con., + where there is pain. C. g. G. con., electric hand massage to affected muscles. In sev erechronic cases, with anæsthesia, apply f. sec., wire brush, local to affected areas. Bennett magnetone, 15-30 min., daily. Helios or Minin violet light, 15 min., daily. H. f. body vac., elect. 10 min., daily. Magnetic wave bath.

Wry Neck (See Torticollis)

X-RAY COMPLICATIONS

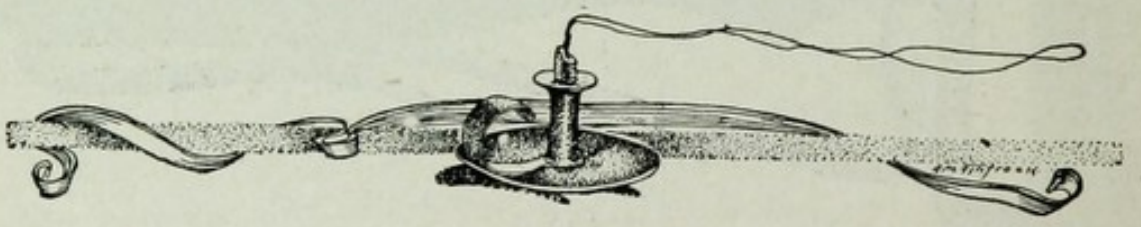
BURNS: (See Burns, X-ray, Dermatitis).

CONJUNCTIVITIS: Avoid all direct exposure to rays. Have lead glass inside fluoroscope. Wear lead glass spectacles. Apply mild Minin violet light bath to eyes after exposure.

DEPILATION: (See Blemishes, Hairs, Superfluous).

DERMATITIS: (See Burns, X-ray, Dermatitis, X-ray).

ZOSTER (See Herpes Zoster, Eczema)



What is Electricity?

This question is often asked by the unthinking and thinking alike, and has never yet been answered definitely. Many theories have been offered, all with some points in favor, but they are none of any practical value to us.

Occasionally we are amused by some one making a "discovery" (save the mark!) claiming to have found out what electricity is, and he either guards his secret (?) closely, or gives a very old and confusing job lot of meaningless words as a definition.

So do not be afraid to show your ignorance as to what electricity is, for you are in very good company, as the wisest do not know, and in that respect we are all wise.

While we do not know *what* it is, we do know what it is *not*. It is not a tangible entity. It is not an energy, as many claim. Electricity is a *condition*. Electrification is an energy, or manifestation of the electric condition, and we know some of the laws governing electrification, and can, by following these laws, bring about certain manifestations of electrification, and get certain results.

Upon this hypothesis, which to us seems the most plausible, that electricity is a condition, and that electrification, in the various modalities which will be taken up and studied in detail later, is the manifesation of this condition, let us proceed to study the different phenomena of electrification, and learn the laws governing the production or causation of these phenomena. The electric condition is universal and pervades everything, and as such, differs from matter, the existence of which we recognize by on or more of our special senses. This condition is not an entity, is imponderable, and while pervading everything, has no dimensions. It is through the manifestation of certain phenomena, only, that we realize the reality of this condition, and it is these phenomena we appreciate by our senses. Electrification is the energy operating to produce these phenomena, and this electrification acts according to certain fixed laws. It is the study of these laws of electrification, which it is our pleasure to place be-

fore you in this "guide." These laws are simple and the principles of their operation are easy of comprehension, and these laws being fixed, knowing them, we can by bringing about certain conditions, invariably cause certain effects.

It is upon the laws governing the production of these phenomena that is based the science of electro-therapeutics, and these laws must be known and followed in order to achieve success.

When electrification is in perfect equilibrium, no phenomena are manifest, but when this equilibrium is disturbed we note the operation of the fixed law of physics, which says that: "For every action there is an opposite and equal reaction."

There is ever present the tendency toward an equalization of balance, the same as water seeking its level. It is upon this that we base our belief in a difference of potential between the two poles. We do not know whether there is a transference of energy in the form of a current, like water flowing down hill, or if it is in the form of a wave, or if it is merely a transmitted impulse. For the sake of convenience in our work we speak of it as if it were a current of energy flowing through media, known as conductors, or held in check by other media known as insulators. These are enumerated in detail elsewhere in this book. Again for convenience we say that the side having the higher potential, is plus or positive, and the opposite side having the lower potential, is minus or negative. Again for the sake of simplicity we will speak of electricity, the generally accepted word, as the same as electrification, so that when we say electricity, please know that we refer not to the electric condition, but to the manifestation of it.

Electrification

Electrification may be divided into four classes, according to the various phenomena of manifestation, as follows:

1st—Electrification in motion, or dynamic.

2nd—Electrification at rest, or static.

3rd—Electrification in vibration, or radiant.

4th—Electrification in rotation, or magnetic.

This classification indicates the relative importance to us as electro-therapeutists, in the order named.

We will consider the most important first, the dynamic, which is generally spoken of in two forms or modes, viz. galvanic and faradic, which are proper adjectives, in honor of Galvani and Faraday. The proper terms to use would be constant and induced.

The constant mode is unidirectional, with a fixed polarity, while the induced mode is an interrupted and alternated mode with no fixed polarity.

Under the head of the constant, may be placed the cautery mode, and under the induced we class the sinusoidal, and the so-called high-fequency modalities.

The franklinic, after Franklin, or static as commonly named, when in effect, is also unidirectional, with a fixed polarity, and it has a modification in the static induced, which while being an interrupted mode, differs from the faradic, in having a fixed polarity, which is always the reverse of the primary or inducing mode. We also get a high frequency or oscillatory modality from the static.

Commercial incandescent light and power modes can be utilized for purposes of therapeutics, but they differ in no way from the other modes, except in the method of generation.

The constant or galvanic mode is spoken of as galvanism, and the application as galvanization.

The induced, or faradic mode, is spoken of as faradism, and the application as faradization

The static mode is spoken of as franklinism, and the application as franklinization on insulation.

The vibratory or radiant mode is known as photo-therapy, or light treatment, and is applied to any form of light, but the term is most often given to the use of the Roentgen or X-ray, which is known as the X-ray treatment, or roentgenism, and the application is called roentgenization, or X-raying or radiation.

The rotating or magnetic mode is known as magnetism, and the application is called magnetization.

$$C = \frac{E}{R}$$

OHM'S LAW

In the erection of our system of practical electro-therapeutics, we wish to have a bridge to carry us over the hard places. The key-stone of this bridge is most important to fully know and understand, and is the law of Ohm, which enters into the consideration of every therapeutic application. The foundation of our bridge is based on three things or units, which we use as measures of pressure, strength and resistance. These are named in honor of the labor and study of three eminent physicists, Volta, Ampere, Ohm.

VOLTAGE is the push, pressure, head or electro-motive force which drives.

AMPERAGE is the rate of flow, or mode strength.

OHMS represent the opposition encountered, or the resistance offered to the flow of mode.

For the sake of convenience we say that the

Volt is the unit of electro-motive force or drive;

Ampere is the unit of mode strength:

Ohm is the unit of resistance.

Dr. George Ohm formulated a definite statement based upon experiments, measurements and observation, concerning these units, and this is known as Ohm's law.

He demonstrated that the strength of a mode flowing through a conductor was entirely dependent upon the pressure behind it, and the resistance in front of it, being directly proportional to the drive, and inversely proportional to the drag.

He formulated a proposition that says, that it requires one volt of pressure or electro-motive force to drive one ampere of mode strength

through one ohm of resistance, in one second of time, but as time element is not important to us we may omit it from our consideration of the subject.

In simple language the law of Ohm is this: "The mode strength (amperes) is equal to the electro-motive force (voltage), divided by the resistance (ohms), thus:

$$\text{Amperes} = \frac{\text{volts}}{\text{ohms}}, \text{ or mode strength} = \frac{\text{Electro-motive force}}{\text{Resistance}},$$

or to make the formula still more simple, $C = \frac{E}{R}$.

HOW ELECTRIFICATION ACTS

The effects of electrification on the body tissues are accomplished through three ways or processes, as follows:

1st—By phoresis, which is mechanical.

2nd—By electrolysis, which is chemical.

3rd—By catalysis, which is physiological.

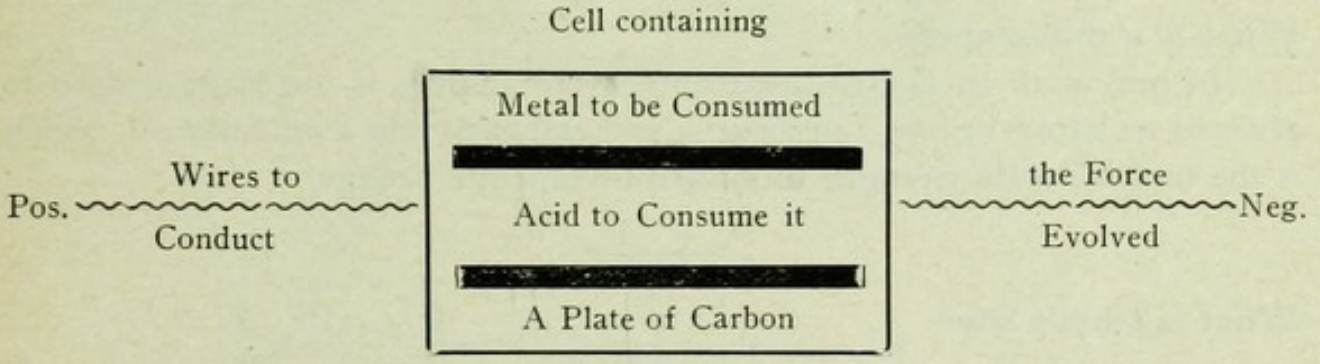
Electrolysis is a chemical effect which is produced by the galvanic mode only.

Phoresis is a mechanical effect which is produced by the galvanic and static modes only.

Catalysis is a physiological effect, which is produced by all of the different modalities—galvanic, faradic, static, magnetic, and radiant—and on account of its widespread distribution is the most important effect of electrification.

A Thousand Questions and Answers

Of what does a cell consist?

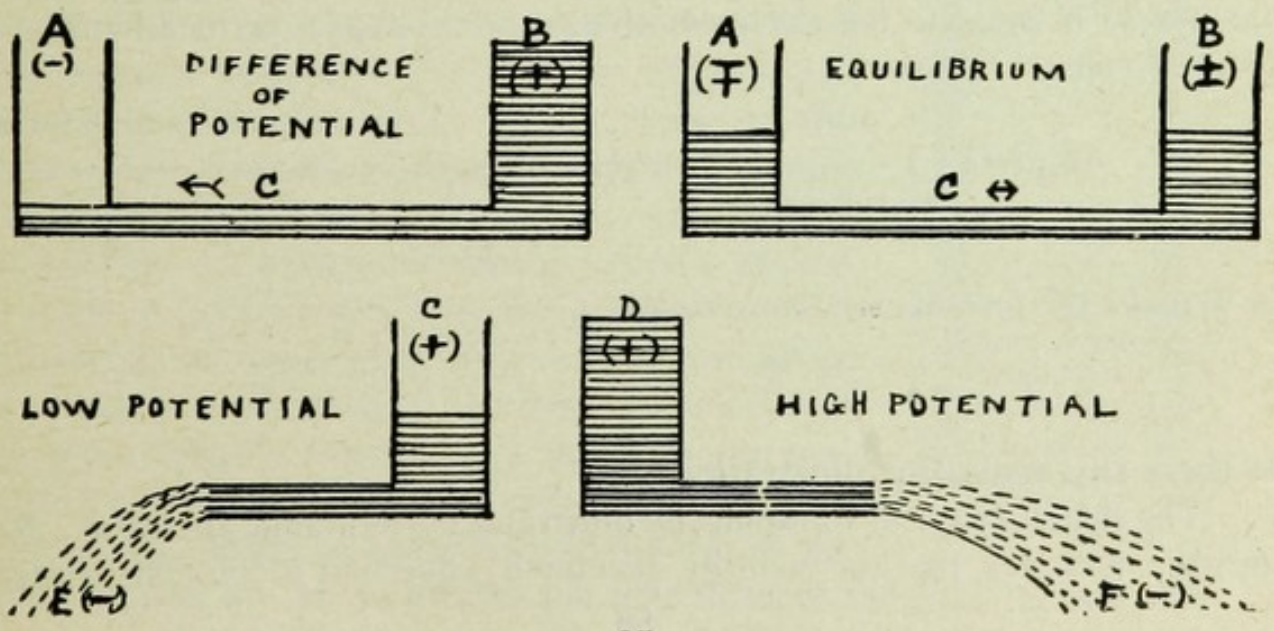


A cell consists of a jar, or container, holding a solution called the electrolyte, in which are immersed two dissimilar substances called elements.

In which direction does electrification flow?

The mode of electrification flows from the place where chemical action in the cell is greatest to the place where it is least, that is, from positive to negative, or from the point of the higher potential to the lower.

What is potential?



Potential is the accumulation of energy at some point in the circuit in excess of that present at all other points, and it is this condition which causes the mode to flow when the circuit is closed, that equilibrium may be restored.

What is a volt, ampere, ohm?

A volt is the unit of pressure, or electro-motive force. An ampere is the unit of quality, or mode strength. An ohm is the unit of resistance, or opposition to be overcome.

What is a milliampere?

In our work as electro-therapeutists the ampere is too large a dose to give, so we divide it into 1,000 parts, and call each one a *milliampere,* which is the unit of mode strength in electro-therapeutic dosage.

What is Ohm's law?

Ohm's law is that the electromotive force, or voltage, is equivalent to the amperage, or mode strength, multiplied by the resistance, or vice versa, that the mode is equal to the voltage divided by the resistance.

Ohm's law is the keystone of the arch of the entire system of electro-therapeutics and is therefore very important. The law enters into every treatment given, and upon its perfect understanding depends in a large measure our success in this field.

What is the symbol or formula of Ohm's law?

In simple language the law of Ohm is this: "The mode strength (amperes) is equal to the electro-motive force (voltage), divided by the resistance (ohms), thus:

$$\text{Amperes} = \frac{\text{volts}}{\text{ohms}}, \text{ or current strength} = \frac{\text{Electro-motive force}}{\text{Resistance}},$$

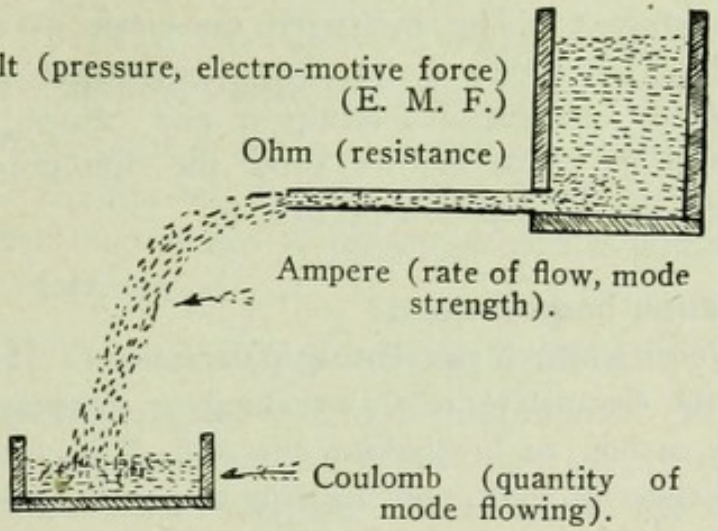
or to make the formula still more simple, $C = \frac{E}{R}$.

Is there any analagous illustration?

The sketch (page 87) graphically illustrates the hydraulic analogue. Remember, however, that the quantity (coulomb), does not accumulate as does

the water in the lower basin, but keeps on flowing, in a stream back to the source from whence it came, no matter where it may be. Therefore we do not reckon the coulomb or quantity. The amperage does the work while it is moving.

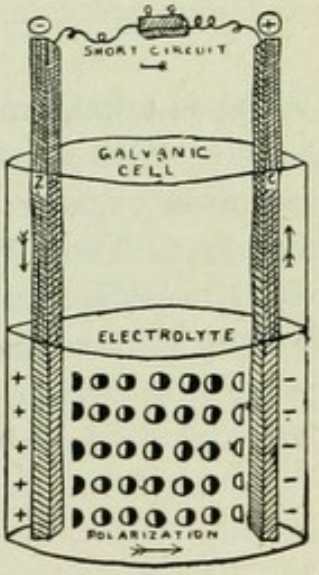
This mode strength is the same in all parts of the circuit. The majority of students do not realize the immense importance of getting this for-

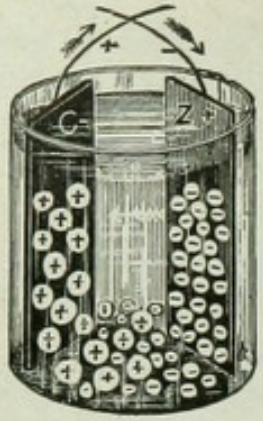


mula clearly understood before attempting to make further advances in the study of electrification, for on this depends all.

What is polarization?

By polarization is meant the condition into which a cell gets, whereby the elements become temporarily similar, and no mode flows for the reason that one element is just as positive as the other in its chemical relationship to the electrolyte. It is caused by the deposit of hydrogen bubbles upon the surface of the negative element, which bubbles of hydrogen are a product of electrolysis of the water of the electrolyte, in consequence of the passage of the mode of electrification before polarization occurs. The accompanying cut shows the theory of this separation of the atoms of water into the polar gases. The black half of the atom being the (—) oxygen going to the positive (+) element zinc and the white half of the atom being hydrogen, (+) going to the negative (—) element carbon. The arrows showing the direction of the mode of electrification flowing to the right in the cell, up the carbon, to the left, through the short circuit, then





down through the zinc to complete the circuit, in its endeavor to find equilibrium of potential.

The accompanying cut shows the progress of polarization. In this illustration the atoms of hydrogen are marked (+) and spread over the carbon plate which is the negative (—) element, and the atoms of oxygen marked (—) spread over the positive zinc element, attacking it. The hydrogen does not corrode the carbon plate, but forms a thin film of hydrogen upon the surface of the element, insulating it and causing a condition of inaction or polarization. The arrows show the direction of the outside mode above, before the polarization occurs.

How can polarization be prevented?

There are several ways of preventing polarization. It may be done by pumping air into the electrolyte, or by brushing or scraping the film of hydrogen gas off the carbon, or by shaking the cell. This brings oxygen into contact with the excess of hydrogen, causing a reuniting and formation of water (H_2O).

This however requires frequent handling of the cell, and if you have many, it is laborious. Polarization may be best prevented by supplying a chemical which is rich in oxygen and at the same time parts with it easily. For this reason, we add to the acid solution bichromate of potash, and in the alkali cells we mix with the carbon, when it is moulded, powdered binoxide of manganese. By these means the excess of (H) hydrogen is taken care of as fast as it is liberated and the cell will not become polarized.

AMALGAMATION

What is amalgamation?

In order to prevent the too rapid rise of potential, due to a too active corrosion of the zinc, we coat the surface of the zinc with a film of metallic mercury. The mercury unites with the hard zinc to form a soft amalgam, which allows only a part of the zinc to be attacked by the acid. This is known as *"amalgamation,"* and not only prolongs the life of the zinc by permitting it to be corroded more evenly and slowly, but also of the electrolyte and causes a more regular rise of potential, and more uniform mode. To amalgamate the zincs, they are first washed free from dirt and grease in a dilute acid, then the mercury is rubbed over the clean zinc till the metal has a bright mirror-like surface. The mercury in the amalgam is also corroded by the acid, and in order to keep the zinc plate amalgamated, soluble

bi-sulphate of mercury is added to the electrolyte. This mercury, held in suspension, unites with the zinc as the amalgam is destroyed, thus keeping it amalgamated. The acid cell batteries are usually constructed so that the zincs may be taken out of the electrolyte when not in use, otherwise they would be corroded and used up when not in use. In the alkali cells the chemical action is less and the zincs are left in the cell all the time.

THE ELECTRO-POION FLUID

What is the electro-poion fluid formula?

The electrolyte used in the acid batteries is called the electro-poion, or battery fluid, or the red-acid solution, on account of the color given to the electrolyte by the bichromate of potash, which is added, as stated before, only to prevent polarization.

TO MAKE THE ELECTRO-POION OR BATTERY FLUID

Take commercial sulphuric acid, 3 fluid ounces. Powdered bichromate of potash, 2 ounces. Rain water, 16 fluid ounces. Bi-sulphate of mercury, 2 drams. Dissolve the bi-sulphate of mercury in the water, then add the bichromate of potash. When dissolved pour in the sulphuric acid, *slowly*, stirring with a stick or glass rod, and allow the mixture to cool, as the mingling of the acid and water generates great heat, and if the mixture is warm it injures the battery. Store in a glass or earthen vessel or jug, in a cool place.

NOTE—If you can obtain bichromate of soda, it will be advantageous to use 3 oz. of bichromate of soda instead of 2 oz. of bichromate of potash, as the bichromate of soda makes a stronger and better fluid; and by the use of this formula, your cells will be kept free from the annoying deposits of chrome alum crystals.

The above formula is best for the following reasons: Decomposition of the bichromate of potash sets free oxygen which unites with the free hydrogen, which would otherwise, by accumulation upon the negative element, polarize the cell. Decomposition of the mercurial salt sets free metallic mercury, which being deposited upon the zinc by virtue of its affinity therefor, amalgamates it, which is desirable for reasons set forth in answer to the preceding question.

CONDUCTORS

What are conductors? Name the best ones.

Conductors are those substances over or through which electrification will spread or pass from one pole to another in order to seek its level or nor-

mal balance of potential. There is no such thing as an absolute conductor, as all conductors offer more or less resistance. The following list shows the various conductors in the order of their quality of conduction and lack of resistance, No. 1 being the best and No. 21 being the poorest of the so-called conductors:

1. Silver (annealed),
2. Copper (annealed),
3. Silver (hard),
4. Copper (hard),
5. Aluminum,
6. Zinc,
7. Platinum,
8. Iron,
9. Lead,
10. German silver,
11. Mercury,
12. Charcoal,
13. Acid,
14. Salt solution,
15. Ores,
16. Sea water,
17. Spring water,
18. Rain water,
19. Snow (wet),
20. Animals (living),
21. Damp earth.

INSULATORS

What are insulators? Name the best ones.

Insulators are substances which by reason of the great resistance they possess, oppose the spread and passage of electrification. There are no absolute insulators or non conductors, because of the moisture in the air, which condenses on the surface of the insulator, forming a film of water, which acts as a conductor. However this is so slight as to be of no consequence, and we speak of insulators as being more or less non conductors, according to their composition and resistance.

The following is a list of insulators classified, No. 1 being the best and No. 18 being the poorest:

1. Dry air (dielectric),
2. Sulphur,
3. Mica,
4. Glass,
5. Paraffine,
6. Fiber,
7. Vulcanite,
8. Shellac,
9. India rubber,
10. Resins,
11. Silk (uncolored),
12. Dry wood,
13. Porcelain,
14. Earthenware,
15. Oils (clean),
16. Paper,
17. Marble,
18. Slate.

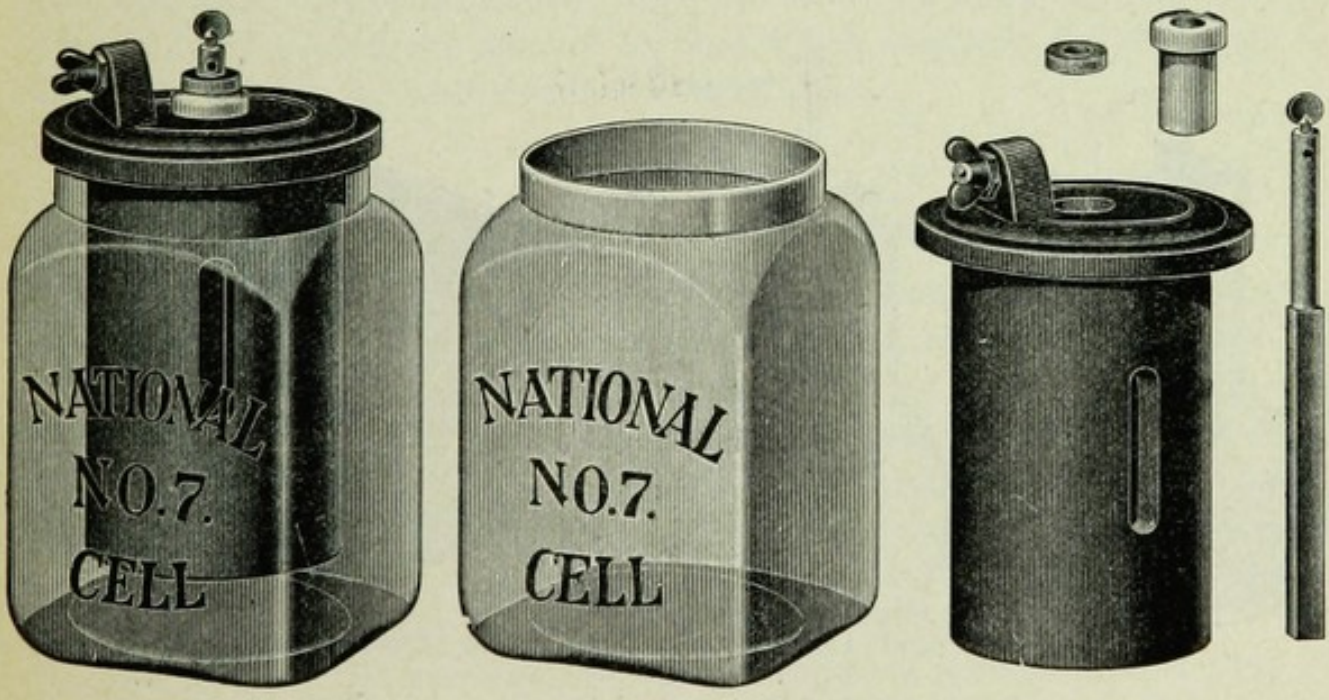
How are the cell elements affected?

We have shown the effects of the electrolyte on the surface of the cell elements, leading to increase of chemical action and polarization. There is also a local action on the zinc itself. Pure zinc is not easily corroded by the acid, but the ordinary cheap commercial article of zinc, is full of impurities, such as iron, arsenic, lead, carbon, etc. These being dissimilar to the zinc, when both are in the acid, we have a closed circuit between the zinc, the impurities, and the electrolyte, in fact many small cells or a battery of cells, acting on the surface of the zinc. This causes the zinc to corrode faster and weakens the main mode. If the zinc is too impure, a hissing noise is heard at the zinc end of the cell, and violent chemical action occurs, heating the cell and weakening it.

How many types of primary cells? Name them.

There are five types of primary cells, which are in common use among physicians for generating galvanic modes.

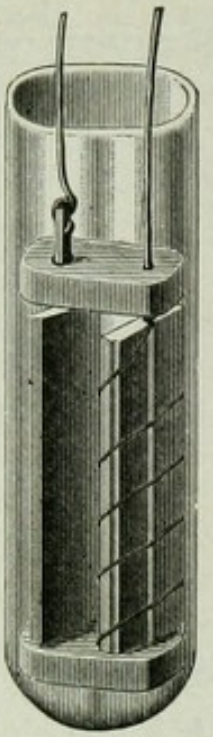
Those most commonly used are: 1, The Le Clanche; 2, Red acid or bichromate; 3, The paste or so-called dry cell; 4, The chloride of silver cell; 5, The blue stone or crow foot, or gravity cell.

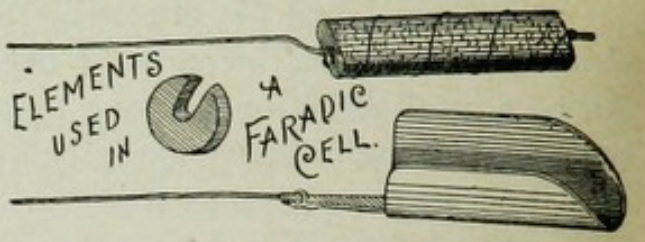


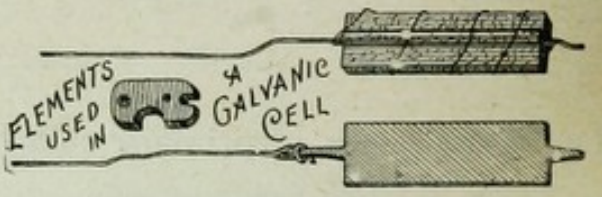
The Le Clanche Cell.



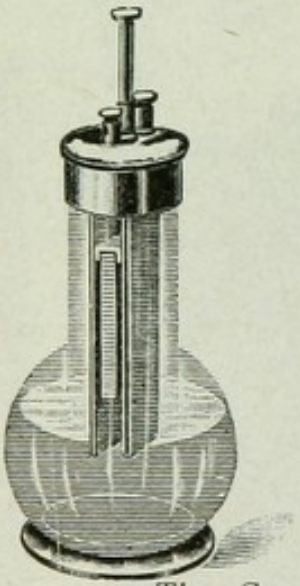
The Paste or so-called Dry Cell.

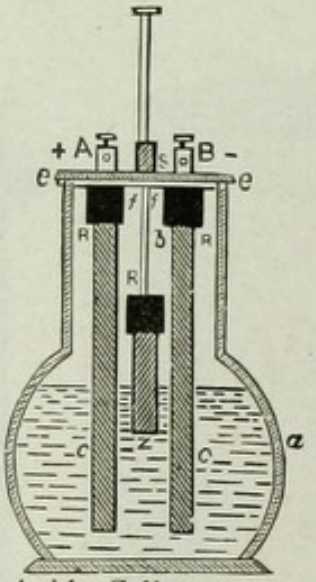




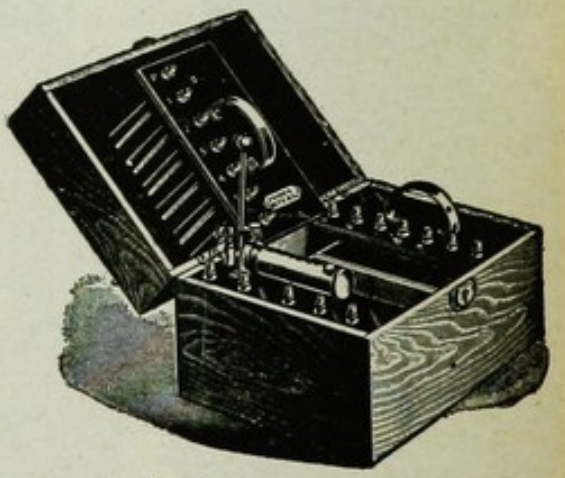


The Chloride of Silver Cell and Elements.

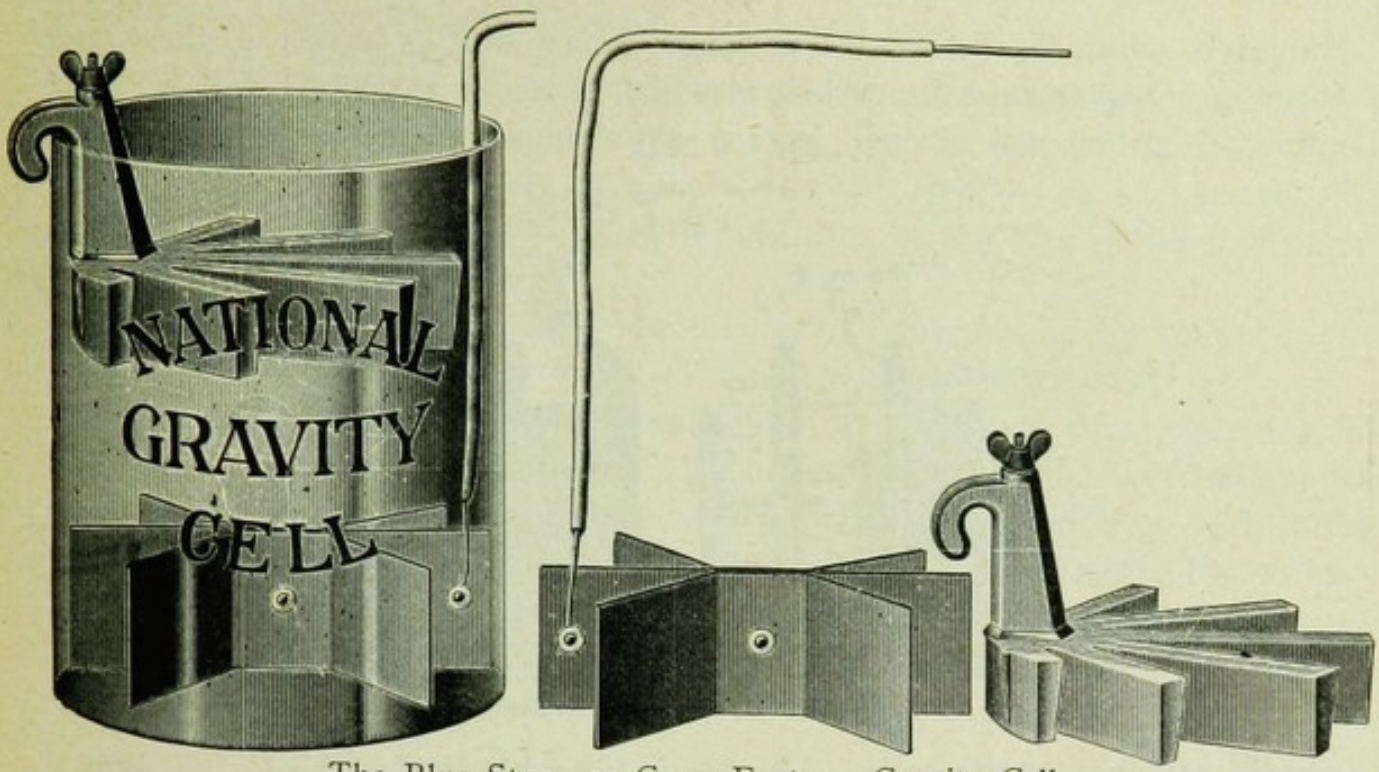




The Grenet Acid Cell.



Nested Acid Cell Galvanic Battery



The Blue Stone or Crow Foot, or Gravity Cell.

What is a Battery?

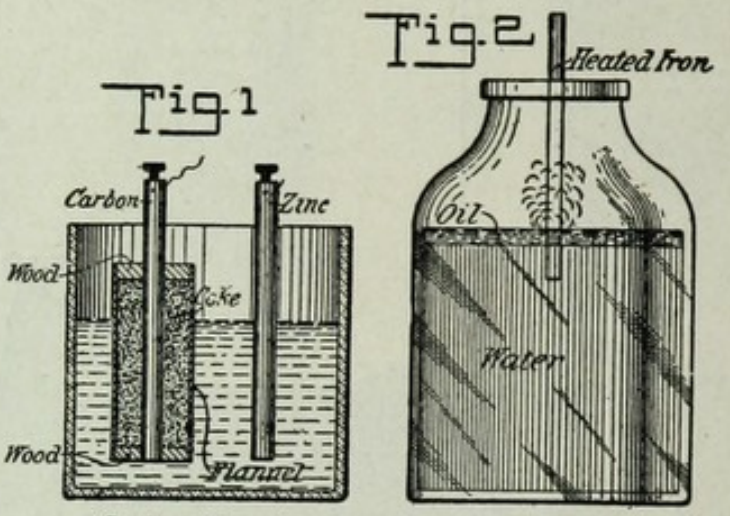
A battery is composed of two or more cells. Those known as "dry cell" are best for portable batteries, for the reason that they are cheap, compact, clean and efficient and require no attention. In fact there is no such thing as a "dry cell." They are called "dry" for want of a more expressive term. They contain a minimum amount of fluid which combines the chemicals to form the excitant in the hermetically sealed cells.

A SEVEN-CENT BATTERY

An electric battery costing but seven cents can be made as follows: Procure a large glass or earthenware jar holding at least one-half gallon. If the top is not level or tapers, a glass jar can be cut level by the following means: Pour water in through a funnel to within one inch of the place where the cut is desired. Then, still using the funnel, slowly pour in linseed oil up to the level of the cut. A red hot piece of iron plunged vertically into the oil will cause the glass to crack at the level of the liquid and leave an open top jar suitable for the battery.

All the materials necessary for the battery are a piece of zinc, a piece of arc light carbon, two circular pieces of wood about 3 inches diameter by ½ inch thick, some fine powdered coke, and some flannel. The illustration shows the method of assembling the parts. The wood has a hole just large

enough to admit the carbon. The flannel is fastened, as shown, to the wood, forming a bag around the carbon in which the coke is packed tightly. The zinc and carbon can be held by any suitable means in the jar, and wires

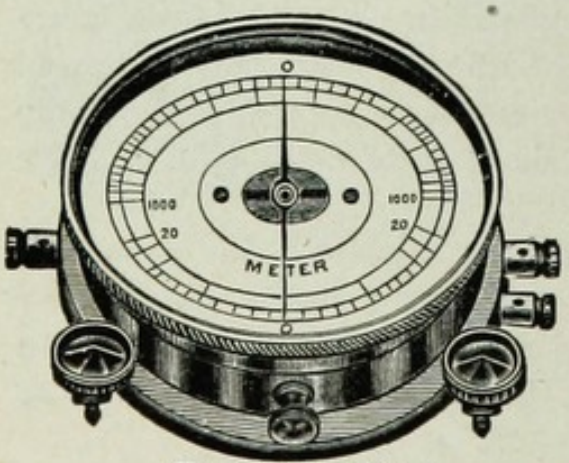


Section of the cell. Cutting the jar.

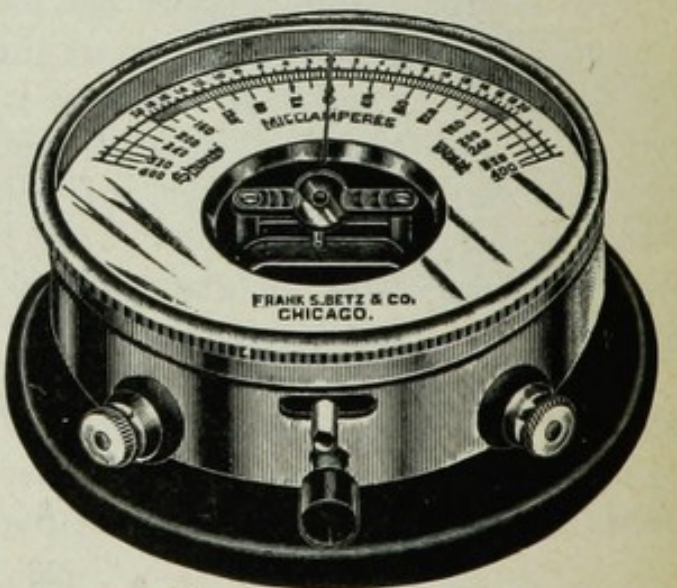
may be attached to the ends. The jar is filled about two-thirds full with a solution of 3 ounces of salamoniac to ½ gallon of water. The battery will be found very efficient owing to the porous carbon element.

What is a milliampere meter, and its use?

A milliampere meter is an instrument for measuring amperage and may be of the terrestrial, or of the dead beat form. The first is in fact a compass needle which is deflected from its proper position on account of the passage of a mode of electrification through a wire placed near it. The amount of deflection is read upon an appropriately arranged scale. The second form consists of a magnet suspended upon pivots between two other magnets, and the indicator comes to its proper position on the scale without oscillation, and the position of the instrument is unimportant, hence it is the more desirable form to use.



Terrestrial Meter.



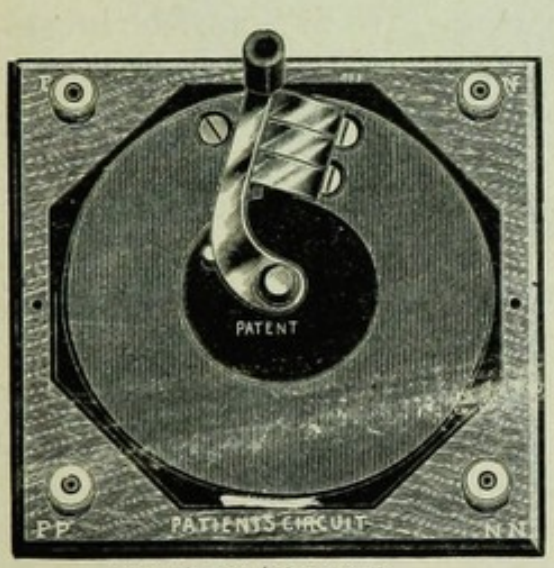
Dead Beat Meter.

What is a rheostat, and its use?

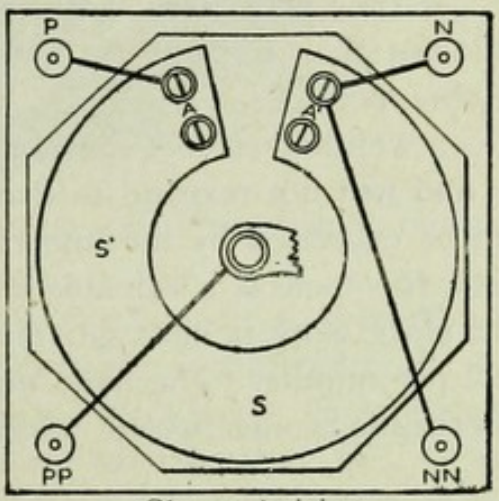
A rheostat may be made in several ways, but the best consists of a sickle shaped sheet of graphite upon a base of slate through which the mode is made to pass by means of a revolving arm with a spring contact, the wires being attached to the graphite and arm by the way of binding posts, connected therewith.

A rheostat is used to vary the amount of resistance in the circuit and to do it so gradually that any shock to the patient will be avoided.

The graphite rheostat is constructed on the shunt principle, thus insuring safety in its employment with either battery or dynamo modes, for the most delicate operations. The mode can be controlled from zero to the full voltage of the circuit absolutely without break or shock to the patient, as indicated by the perfect evenness with which the needle of a sensitive milliampere meter travels forward or backward as the mode is increased or diminished.



Graphite Rheostat.



Shunt Wiring.

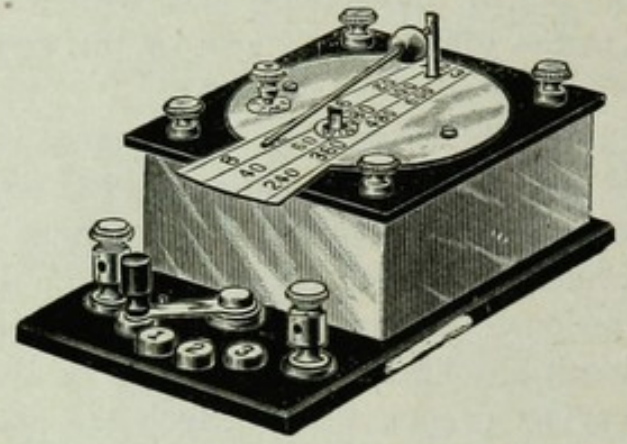
In delicate operations a mode as small as one-thirtieth of a milliampere is frequently sufficient; but if the operation is to be painless, the control of the mode must be absolutely perfect.

Remember:—This is a shunt rheostat with carrying capacity of one-half ampere, therefore, in using this controller with either the constant or the alternating dynamo mode, it should be used in series with a 16-candle power lamp.

Caution:—Use care not to allow either grease, vaseline or oil to come in contact with the graphite surface, as the graphite is quickly removed by any free oil.

What is a rheotome, and its use?

There is a mode breaking device, the "rheotome," which works automatically, breaking in gradations either the galvanic or faradic.



We show you here an automatic graduated interrupter or rheotome, which can be connected with any battery, to give slow or rapid breaks of the mode; and may be adjusted so as to give from 8 to 660 breaks per minute. It runs by a clock work, and has a switch inside and a sliding ball or pendulum on a rod outside for regulating the number of breaks, at the will of the operator.

It is a well known fact that long after a muscle has lost its faradic irritability and will not respond to that mode, it retains its galvanic irritability and can be exercised by the interrupted galvanic mode, and the graduated automatic rheotome is a valuable aid in this class of work.

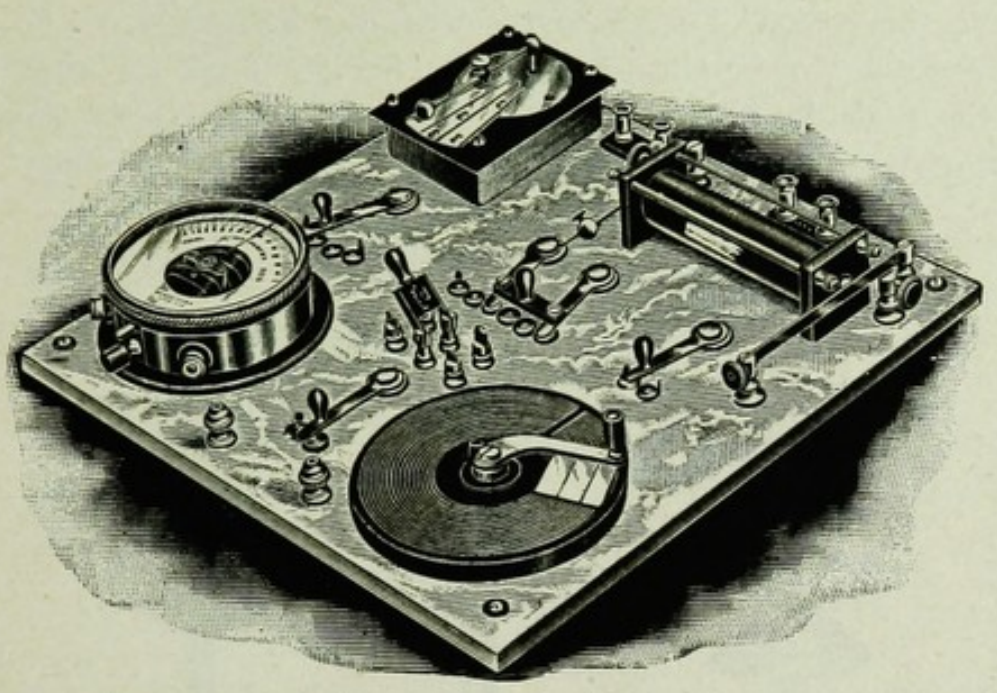
The clock work is most satisfactory where the interruptions range from 8 to 660 per minute. The hand motor is best suited for slower and irregular interruptions, the electric motor for a higher number per minute.

What are switchboard essentials?

Switchboard essentials are a milliampere meter, rheostat, rheotome, pole changer, with appropriate switches for each, also binding posts for attachment of battery wires and rheophores. A faradic coil may also be added.

We show here a table or wall plate with the essentials for complete galvanic and faradic outfit. It can be used with either cells or the incandescent mode. When this switch board is used the cell selector is not used, and the cells are all connected in series, and the wires leading from the carbon of the first cell and the zinc of the last cell, are brought up to the intake posts of the switch board, the same as the wires brought from the

street mains, and thence conducted through the different apparatus to the outlet posts or the patient's circuit. When used with cells, they are all used, and the voltage cannot be controlled as in the case of the cell selector, which is sometimes a disadvantage where there is very little resistance to overcome, as the mode of 5 milliamperes from a battery of 50 cells with a pressure of 75 volts behind it, is much more painful about the face than the same strength of mode, from 10 cells with only 15 volts behind it.



Please remember that the important parts of the galvanic outfit are as follows:

1, Galvanic cells; 2, pole changer; 3, interrupter; 4, rheostat; 5, milliampere meter; 6, binding posts; 7, conductors; 8, electrodes.

1. The cells may be of any kind you may select. Those best adapted to an office cabinet are the Le Clanche wet sal-ammoniac cell, or the paste or dry cell, and may be placed in any convenient place, closet, cellar, attic, or in the cabinet itself. Be careful that they do not touch and see that they get fresh water added to them occasionally to replace the loss by evaporation.

2. A pole changer is usually a double lever switch so connected that by moving it over, the poles are the opposite to what they were at first. This switch is simply for convenience. One simply avoids having to change electrodes or cords when wishing to change the polarity. The pole changer is also a slow alternator, by means of which powerful shocks may be given where great stimulation is required.

3, 4 and 5. The interrupter, rheostat and meter have been fully described before.

6. The binding posts are small metal posts to which the ends of the

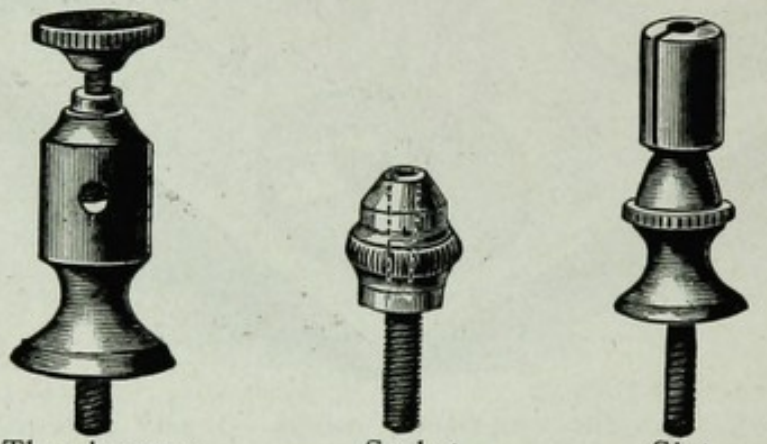
conducting cords are attached. They are simply used on account of their convenience.

7. Conducting cords or rheophores are for conveying the mode from the battery to the electrodes or applicators, and they may be of wire, or tinsel cord covered with cotton, wool or silk.

The tinsel cords are the cheapest and most flexible, but the wires are the best conductors. The silk cover is the best insulator, and the nicest looking, but the cotton or wool covers wear the best.

8. Electrodes or applicators are the devices used for conveying the mode to the patient. The surface of the ordinary electrode should be of carbon or of metal, nickel plated. The electrodes, for ordinary purposes,

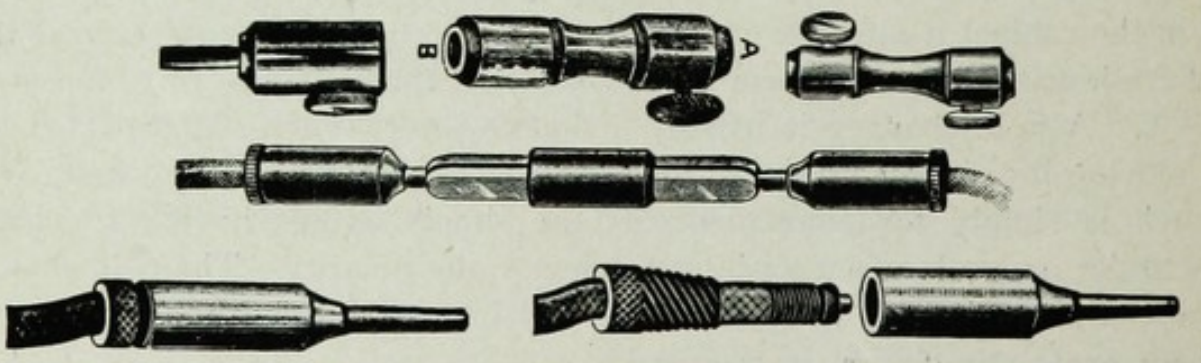
BINDING POSTS



Thumb-screw. Socket. Slot.

are covered with sponge or absorbent cotton. The latter is the most cleanly and should be used oftener than it is.

Whether sponge or cotton is used it should be moistened in a saline solution.



Adjustable Cord Tips.

The above cuts show an adjustable cord tip to attach to the ends of the rheophores. These can be easily removed and replaced when the cords

From ZINC of 40th or Last Galvanic Cell to Galvanic Post Marked "N"
From CARBON of 1st Galvanic Cell to Galvanic Post Marked "P"
From ZINC of 3rd Faradic Cell to Faradic Post Marked "N"
From CARBON of 1st Faradic Cell to Faradic Post Marked "P"
Gal.
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wear off. They have a tapering tip so as to fit into any hole of different sized binding post.

The three cuts (page 98) show three forms of binding posts, for the convenience of attaching conducting cords or rheophores to either the battery plates or to the various electrodes.

Page 98 shows a very convenient "handy connecter," to join short cords together to make a longer one, if needed. The holes A and B are for the ends of the cord tips.

How are the cells connected to the switch board and each other?

Cells are connected to a switch board by wires, one from the zinc of the first cell, and the other from the carbon of the last cell in the series. Cells are connected to each other by means of short wires from the carbon of one cell to the zinc of the next cell.

(This diagram showing cells and connections does not refer to any particular cell, but is intended to show how to connect the negative and positive elements of any form of cells in series, and with the plate.)

DIRECTIONS FOR SETTING UP AND CHARGING GALVANIC CELLS

Charging the cells:—Fill each jar two-thirds full of clean water, add a package (4 oz.) of sal-ammoniac stir with a stick of wood until all the salt is dissolved. Place the carbon and zinc in the jar, being careful not to get the fluid on the outside of cell or connections.

Connecting the cells:—Place the cells in a cabinet, or on shelves, as desired, then connect zinc of first cell by means of a short wire, with the carbon of next, and so on until all are connected; (that is, zinc to carbon; zinc to carbon; zinc to carbon) and so on until all are connected in a continuous chain. Do not connect zinc of last cell to carbon of the first. See diagram of cell connections, shown on page 99.

VOLTAGE MODIFICATIONS

What is voltage, and how modified?

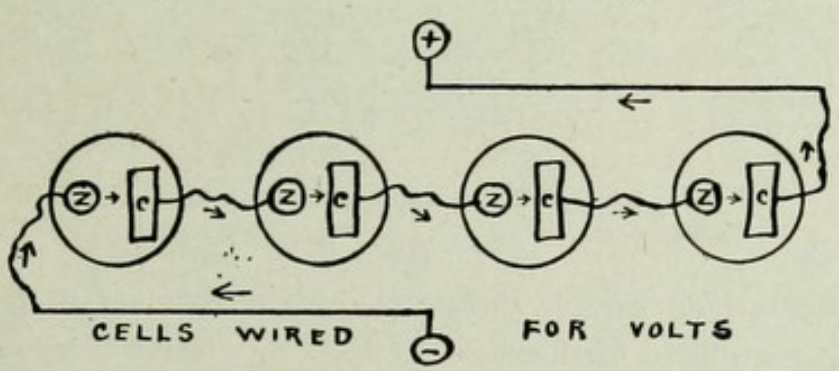
Voltage, or electro-motive force, is the push, pressure, or drive of the electrification, and this can be modified, according to Ohm's law, by varying the resistance. But this modification is made after the initial voltage

is started. It now remains to be shown how the initial voltage may be changed.

This may be influenced by the kind of elements in the cell. Difference of potential is greater between a metal easily corroded by acid, as zinc, and an element not at all corroded, as carbon.

The voltage is modified by the kind of electrolyte. A strong acid will attack zinc more powerfully than a weak acid, or an alkali.

It would also be made weaker if the zinc was covered with salts, or nearly destroyed, or not properly amalgamated, or by the length of time in use. The voltage depends largely on the number of cells used. We can vary the voltage by adding cells. The voltage of a battery depends on the number of cells, not on the size of the cells. Every cell has a certain voltage, no matter what the size of the cell. Different kinds of cells, with different kinds of elements, and different electrolytes have different voltages. *Everything else being equal,* the voltage of a cell the size of a barrel is no greater than the voltage of a cell the size of a gun cap.



The accompanying sketch shows four cells connected together in series for voltage. The carbon of the first cell, connected to the zinc of the second, the carbon of the second to the zinc of the third, and the carbon of the third to the zinc of the fourth. Then the wires from the zinc of the first cell and from the carbon of the fourth cell have four times the voltage, or power of overcoming resistance, in an outside circuit, than would the wires from any one cell. The mode strength of the four cells is no greater than that of one cell, but, as we have shown by Ohm's law, increased voltage overcomes more resistance, allowing greater amperage to pass through the resistance.

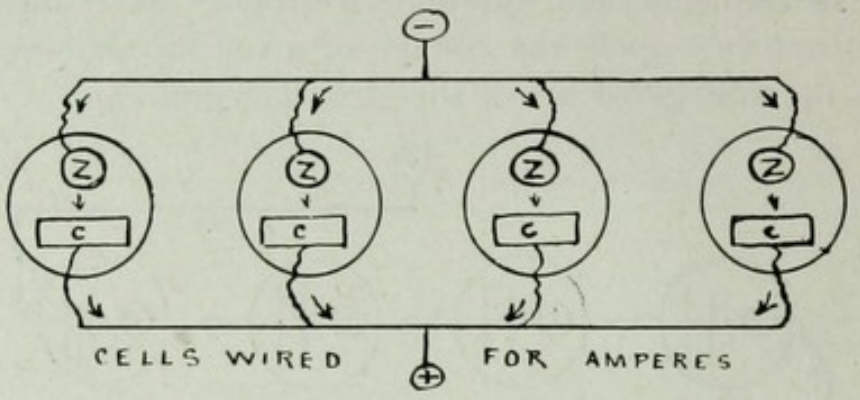
AMPERAGE MODIFICATION

What is amperage, and how modified?

Amperage is the quality of mode and it is modified by the size of the elements, the depth of their immersion in the electrolyte, their nearness to each other, and the amount of resistance in the circuit. The number of

cells added increases the amperage by enlarging the amount of area of the elements exposed to chemical action, when they are connected in parallel, that is, all zincs connected to one supply wire and all carbons connected to the other supply wire.

The mode strength or output of a battery may be varied by the size of the elements, by their proximity and by the area of the surface acted upon by the electrolyte. Larger elements offer more surface for corrosion and a consequent increase of chemical eneregy and potential. The closer the elements are together in the cell the less the internal resistance offered. The deeper the elements are immersed in the electrolyte, the greater the surface for corrosion and mode strength. As we cannot get large elements into a small cell, therefore the size of the cell makes a great difference in the output of electrification, or mode strength or amperage.

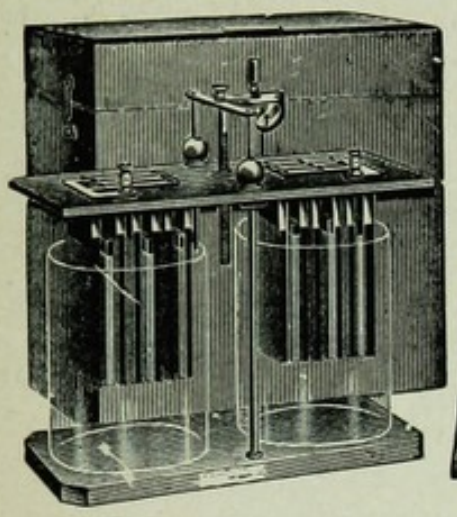


The accompanying sketch shows four cells connected together in parallel for mode strength (amperage). Here we have four small cells all alike, each with a certain voltage and amperage, but by connecting all the zincs to one wire and all the carbons to another wire while we have not increased the voltage at all, we have increased the amperage four fold, because we have the equivalent to one large cell with just four times the corrodable elemental surface. This method of connection is called "multiple," or "parallel," and is the method used when it is desired to pass heavy modes through slight resistance, and therefore, according to Ohm's law requiring low voltage. This plan is employed in cautery work.

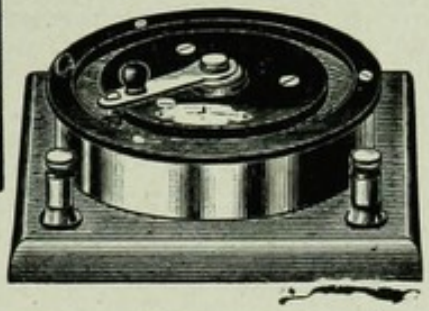
What is a cautery battery, and its use?

A cautery battery is one where the cells are connected in "parallel" for amperage, and the resulting mode is compelled to pass through a wire whose resistance is great enough to heat it red hot. It is used for any purpose that requires cautery. If a "wet" battery, the zincs should not be allowed to remain in the electrolyte, except when the battery is in use.

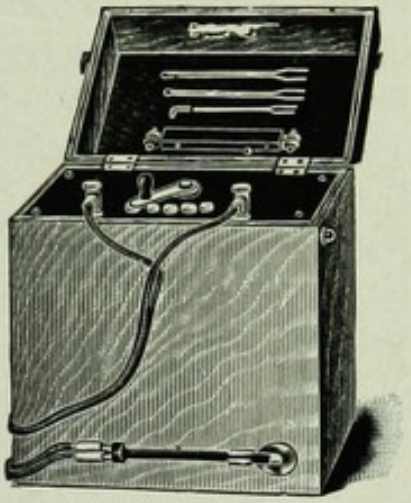
Any kind of cautery battery is used to burn or cauterize the tissues, wherever such treatment is desired. It is based upon the principle that the passage of a large mode of electrification through a small wire, offering



Plunge Cautery.

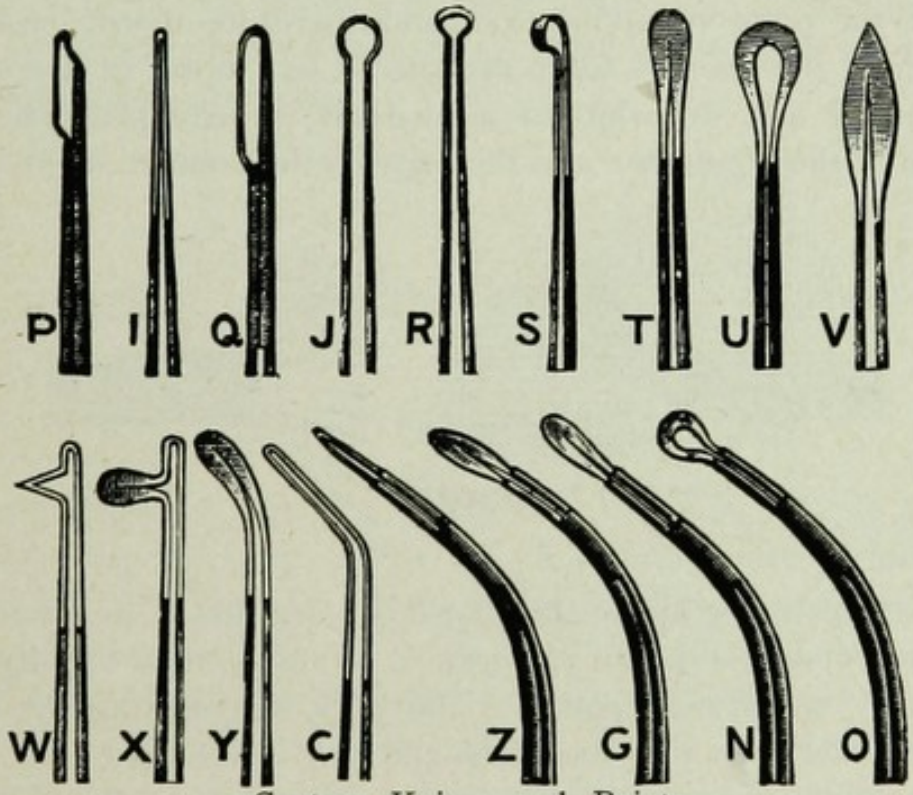


Cautery Battery Rheostat.



Dry Cell Cautery.

high resistance, generates heat. The cells of a cautery battery are few in number, generally from three to eight, but the elements are very large, in comparison with those of the galvanic battery, thus creating a mode of very large volume or amperage, and of very low pressure, or voltage.



Cautery Knives and Points.

This shows a number of platinum knives and points, which experience has proven to be the best adapted for cautery work.

What is a storage battery, and its use?

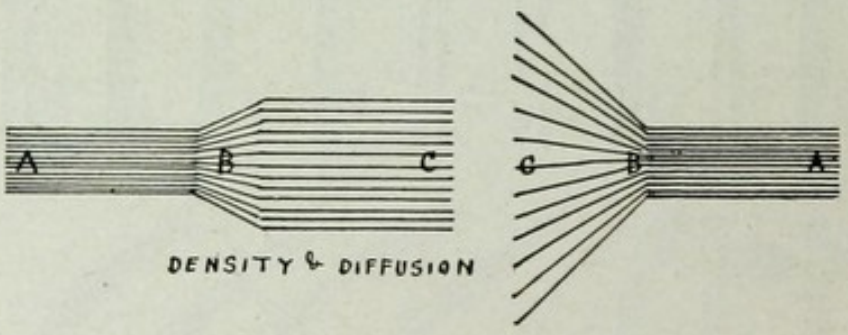
A storage battery consists of two elements, an electrolyte and a jar, or a number of them, connected together. The elements are both lead. There is no mode, on account of the similarity of the elements, until a mode of electrification has been passed through the battery, which changes one of the elements to oxide of lead, by electrolysis of the water in the electrolyte. Then the mode begins for the same reason that it bgins in any cell. Sometimes one of the elements is partially prepared in advance by perforating it with holes and filling the holes with oxide of lead. This kind of battery may be used for cautery work, or for running such machinery as fans, etc. It is heavy and not easily moved about. It is also an expensive kind of battery. This prepared element is called a *"grid."*

DENSITY AND DIFFUSION

What is understood by density and diffusion?

Density and diffusion are terms used to refer to the mode of transmission of the mode through the patient's body. They vary with the size of the electrode. Where the mode passes through a small electrode it is concentrated at the point of application, and therefore more dense. With a larger electrode the lines of force are spread out more, or are diffused.

The density and diffusion of a mode is directly proportional to the conductivity of the conductor and the area of the contact surface.



By referring to the above sketch we can see that if the conductivity of the left hand conductor is the same at A, B and C then the density of the mode will vary in different places. The lines representing the mode at A are closer together than they are at B, and at B more than at C. By referring to the right hand sketch we see that the dense mode at A begins to diffuse at B, until at C, the point of contact, the mode is widely diffused over a large area, and that the mode is equally distributed over all parts of the surface at C.

We can take advantage of this when we wish to apply a large dose to a sensitive surface. By spreading it over a larger area it divides the resistance, and lessens pain.

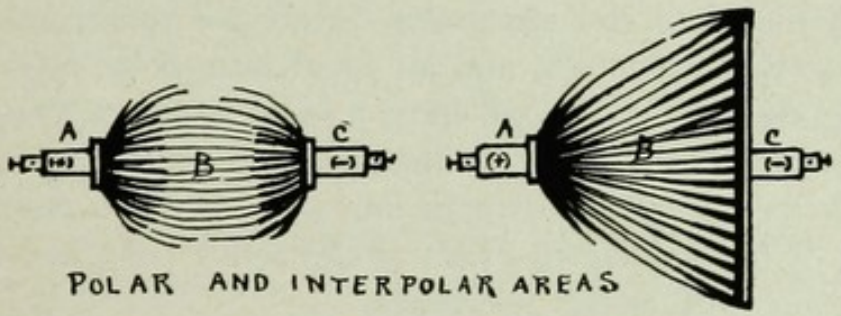
POLAR AND INTER POLAR EFFECTS

What are the polar and inter polar effects?

We have shown the local action going on inside the cell, resulting in polarization. It now remains to speak of the local polar, and inter polar effects of the electrification, outside the cell, and in the body tissues.

The chemical, mechanical and physiological polar effects of electrification will be explained later under the heads of electrolysis, phoresis, and catalysis. We will here only briefly state that the results or effects of electrification, passing through the body tissues, are very different under the two poles, and between the poles. These effects may be increased or diminished, according to whether we condense or diffuse the mode through the tissues, and is directly proportional to the density, diffusion and mode strength.

Electrification is a great worker under all conditions and circumstances, but is also somewhat of a lazy dog, and always takes the easiest route, and goes by the way of the least resistance, regardless of distance. It also expends its greatest efforts where there is the most work to do, i. e., the greatest resistance to overcome.

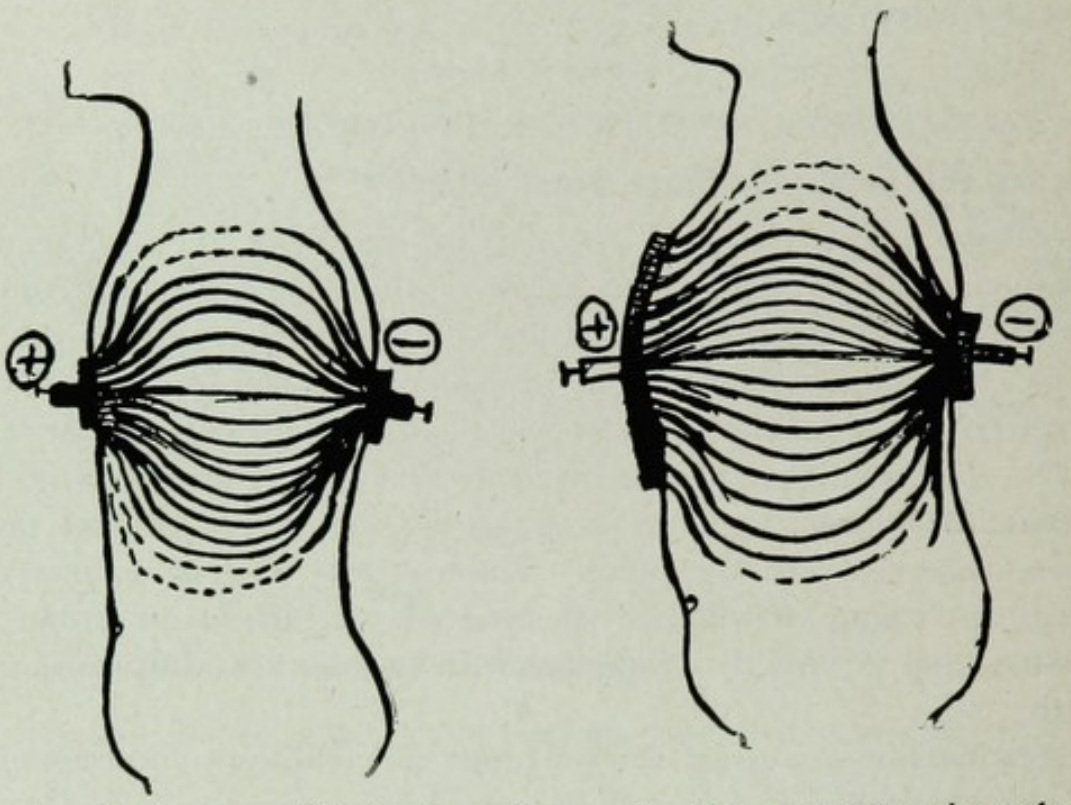


POLAR AND INTERPOLAR AREAS

The accompanying sketch will illustrate the polar effects at A and C, and also the inter-polar effects at B. In the left hand cut we have two electrodes, A and C, of equal size, thus giving equal polar effects under them, and a uniform diffusion of the inter-polar effects at B, where the lines spread out, become thin, then thicken and again come together.

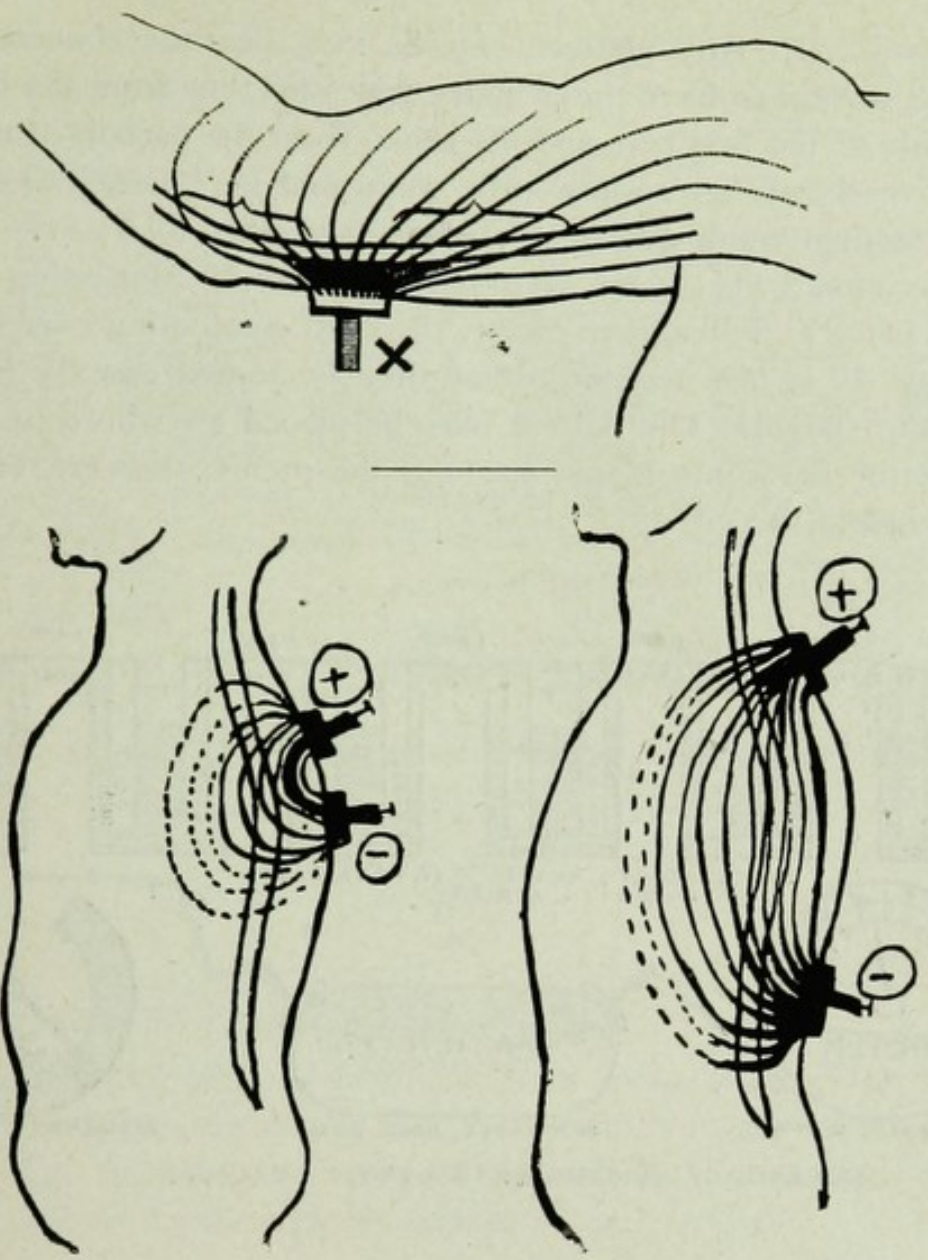
In the right hand cut we have the same size electrode at A but an electrode eight times as large at C. Hence the local polar effect manifested at A will be just eight times as marked as it will be at any spot of the same area under the electrode C, and while the aggregate polar effect at C will be the same as at A the same will be so distributed as to be of less

effect in any part of C. Also the inter-polar effect at B gradually diffuses between A and B.



These effects are still further shown in the accompanying sketches, showing the diffusion of the field of influence of the mode, when passed through the human body from chest to back. The left hand cut shows the positive (+) electrode on the front, and the negative (—) electrode on the back with the same size electrodes. Here we would get marked local polar effects at both terminals, and an equal inter-polar effect through the body. In the right hand cut we have a large positive (+) electrode in front, and a small negative (—) at the back and a more uneven inter-polar effect between them. In these treatments while both poles are at work we usually speak of the smaller electrode as the active pole, and the larger one as the passive or "dispersive" electrode.

The sketch (top page 107) shows a concentrated effect under the active pole, which in this case is the positive (+), applied to the extensor surface of the upper arm. The two parallel longitudinal lines are made to represent an ulnar nerve, which is being treated with a (+) mode, for the local polar positive effect, while just beyond the local positive (+) area, is a more diffuse general (+) zone of action. In this case the indifferent or passive pole is placed so far away as to obliterate any decided inter-polar effect, except in a mild and general way, for tonic effect, which will be explained more fully under the head of catalysis in another part of the book.



The above two sketches show the polar and inter-polar effects of electrodes of the same size when applied to the spine. The left hand cut showing a local or restricted field, in the upper dorsal region, and the right hand cut showing general or extended field of action, between the lower cervical and the lumbar regions. In these treatments, both poles may be said to be "active," and the inter-polar action pronounced.

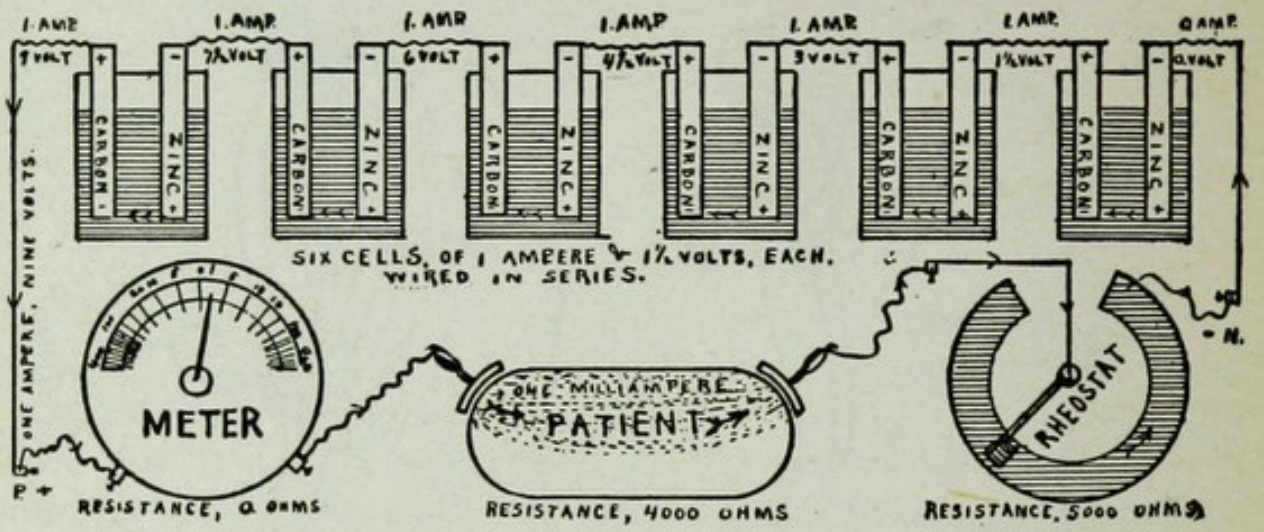
What is meant by "series" connection?

Cells are in "series" connection when the carbon element of the first cell is attached by a short wire to the zinc of the second cell, and the primary wires lead, one from the zinc of the first cell, and the other from the carbon

of the second cell. Any number of cells may be thus connected to each other, being careful to have the primary wires leading from the battery, one from the zinc of the first cell, and the other from the carbon of the last cell.

We have shown before how cells connected in "series," like a train of cars, or a tandem team, give increased voltage.

The accompanying sketch shows the scheme of connecting in a series circuit, the battery, milliampere meter, rheostat, conducting cords, electrodes and patient. It is not necessary that they be joined exactly in the same order as here shown. The patient may be placed anywhere in the outside circuit, but the mode must pass through the meter, rheostat, etc., and patient to complete the circuit.



SCHEME OF WIRING OF GALVANIC CIRCUIT

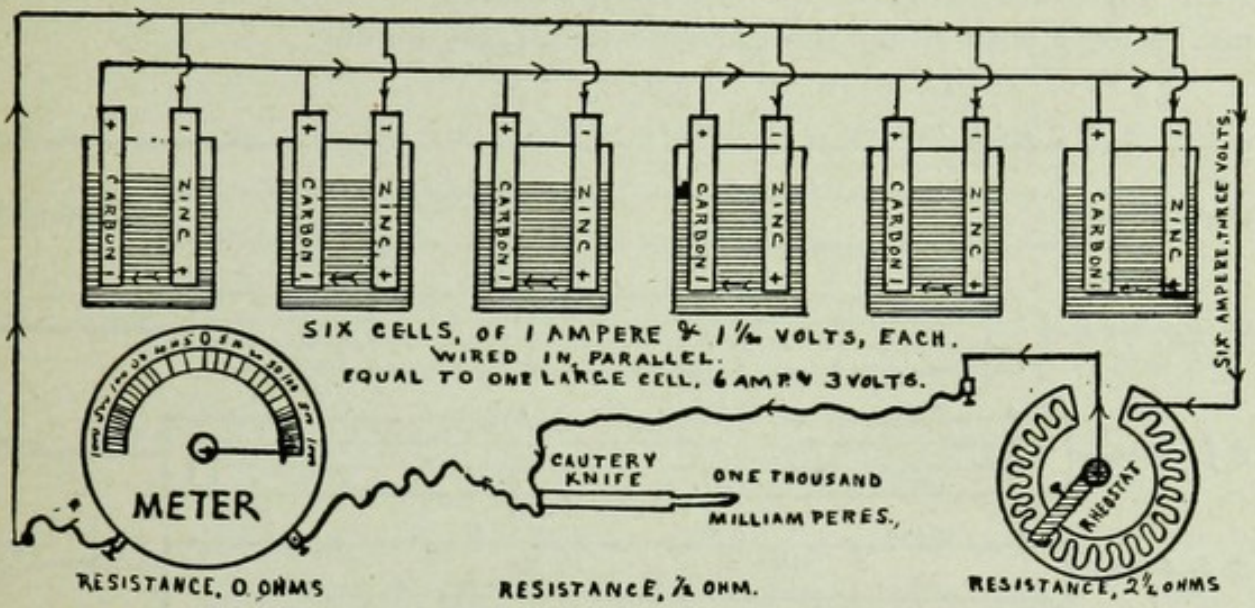
What is meant by "parallel" connection?

Cells are in "parallel" when one primary wire running the length of the battery is connected to each and all of the zincs, while the other primary is similarly attached to all of the carbons.

We have shown how amperage or mode strength can be modified by connecting cells in "multiple" or "parallel," thus greatly increasing the surface of zinc to be corroded, and therefore increasing the potential and amperage. This way of connecting cells, to get a mode of great strength or amperage, and little pressure or voltage, is used in the cautery battery for cautery work.

The sketch (page 109) shows the scheme of wiring of a battery of six cells, arranged in "multiple" or "parallel" for volume and also shows

how such a multiple battery is connected, in series, with a milliampere meter, rheostat, cautery cables and cautery knife.



SCHEME OF WIRING OF CAUTERY CIRCUIT

How do galvanic and cautery modes differ?

Galvanic modes proceed from batteries connected in "series," and are different from cautery modes in that their voltage is high and the amperage is low, whereas the latter have low voltage and high amperage. The cautery modes are derived from batteries connected in "parallel."

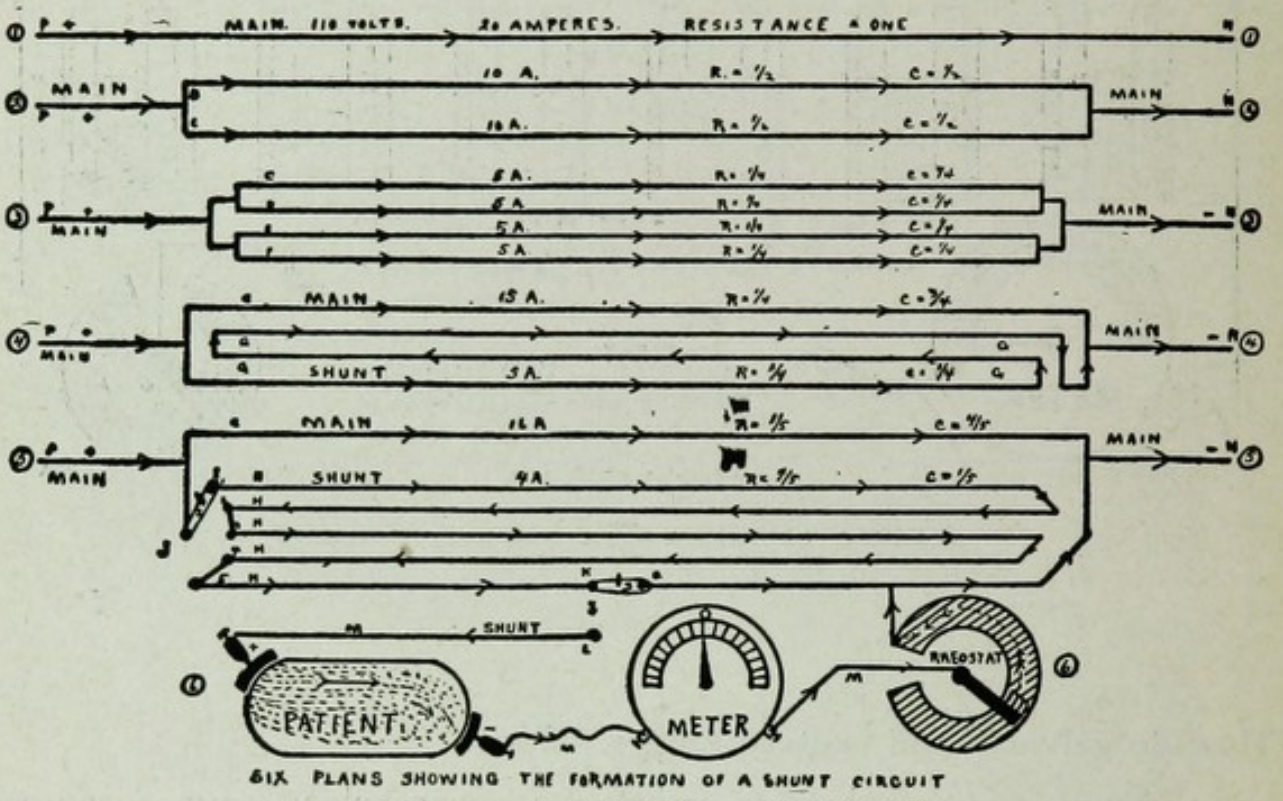
What is meant by "in shunt?"

"Shunt" means where a heavy mode is made available for therapeutic use by subdividing it by means of several wires of different sizes, or lengths, or both, whereby a mode approximating the desired strength may be obtained by putting into the circuit the branch wire carrying such reduced mode.

If a mode of electrification is allowed to traverse a number of conductors, it will always choose the path of the least resistance, without regard to length, just as water running down hill, and meeting with some obstruction in its path, will flow around it.

"Shunting" is sidetracking and may be compared to the branching of

a stream or river as shown in the mill race, where the water supply may be derived from a river running at any velocity; by grading the race to a given fall the velocity is attained independent of the river. The rheostat may be used with either the galvanic or faradic modes.



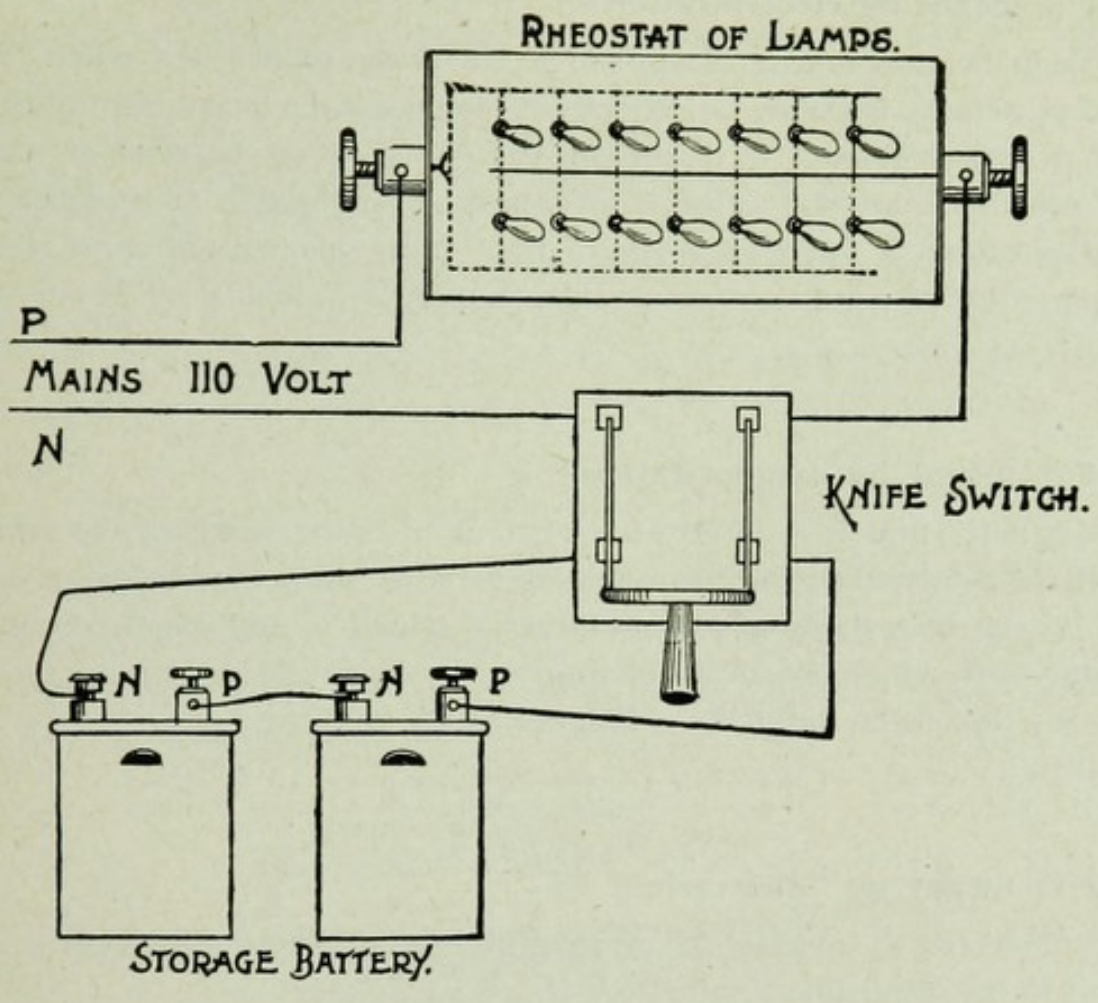
SIX PLANS SHOWING THE FORMATION OF A SHUNT CIRCUIT

We will call attention to the accompanying sketch in which are shown five main wires, each different, but showing the various steps in the development of a "shunt" as adapted for the control of heavy modes, so as to modify them for use in electro-therapeutics.

When we speak of the wires coming from a chemical cell or battery, we call them the "primary" or "prime" wires, carrying a "primary" mode in contradistinction to a "secondary" wire, which carries a "secondary" mode. When we speak of the wires coming from an incandescent or street circuit, we call them "mains."

SHUNT LAMP RHEOSTAT

The sketch on page 111 illustrates the principle of a shunt when used to charge a battery of storage cells. Here the storage cells are wired in series with a double knife cut-out switch, one side with the negative main (N), the other in series with a rheostat made of fourteen incandescent lamps wired in parallel and connected to the positive main (P).



HOW TO TELL THE POLARITY OF YOUR BATTERY

How do you tell the polarity of a battery?

The positive pole galvanic is acid, and the negative alkaline.

Wet a piece of blue litmus paper; place upon it the cord tips from battery, and turn on mode. The paper under positive end will turn red, and the negative tip will burn bluer. Reverse the position and the red spot will again turn blue, showing both acid and alkaline reactions of different poles.

Place cord tips in water and turn on mode. Bubbles of hydrogen will come from the negative tip, while positive tip will turn black, be covered later with white, and nickel will be destroyed.

Place cord tips in saturated solution of iodide of potash; turn on mode, and free iodine will be liberated at positive pole and will color water brown.

Attach cords to steel needles, and insert them into a piece of fresh, moist beef, turn on mode, and the positive needle will stick fast, while the negative will remain loose, and be surrounded by froth.

What is meant by electrification?

Electrification is a term applied to the force manifested when, through chemical action, friction, or otherwise, the normal electric equilibrium existing in any substance is disturbed, thereby creating between it and some other substance, what is called "difference of potential." This difference of potential causes a mode of force to flow from one substance to the other, when a suitable conductor intervenes, which is called a mode of electrification.

What is meant by magnetization?

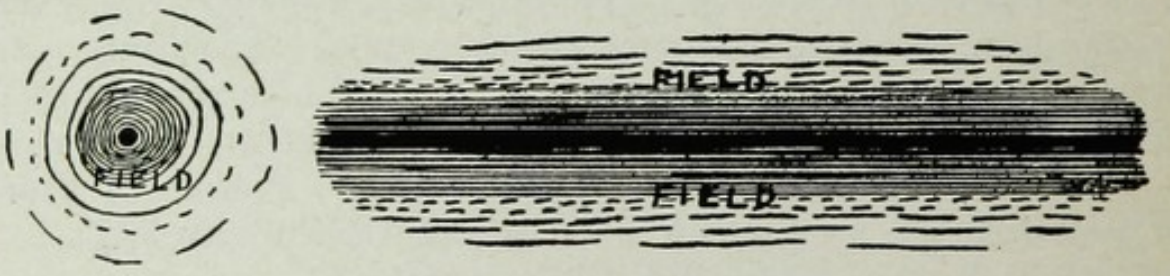
Magnetization is a force somewhat akin to the force of electrification, but differs principally from it in that its force is not prevented from exerting itself by the interposition of a di-electric, which is any elastic, transparent substance, of which air is an example. It manifests polarity. Lodestone possesses this force naturally. Magnetization may be intensified by electrification.

What is meant by "dielectric?"

A dielectric is an elastic, transparent insulator, and this term is usually applied to the atmospheric air.

What is meant by "field" and "lines of force?"

Any conductor, when energized by a mode of electrification, is surrounded by an area or zone of electric influence, the strength of which is directly proportional to the initial electric potential and to the distance from the conductor.



The accompanying sketch represents this zone, or series of zones, of influence surrounding a live wire. The right hand cut shows the heavy concentrated zone close to the live wire in longitudinal section, while the small left hand sketch shows the same in tubular or ring zone arrangement around a live wire in a cross section. This area of more or less active in-

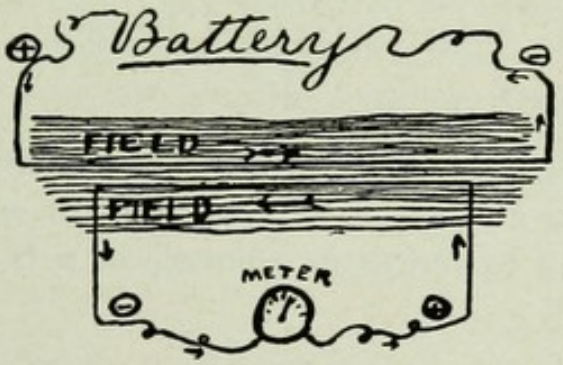
fluence surrounding the live wire is called the *"field,"* and the different zones, as represented by the parallel and circular lines, are called *"lines of force."*

What is meant by electric induction?

Electric induction is the process by virtue of which a mode of electrification is created in a wire by the passage of a mode of electrification through another wire lying parallel to it. It is by this same process that magnetization creates a mode when the wire is brought within the "magnetic field."

What is an induced mode, and in which direction does it flow?

The induced mode is the secondary mode set up in the parallel conductor, immersed in the "field," and flows in the opposite direction to that of the "primary" or inducing mode.



This is shown in the accompanying cut. Here is a primary live wire from a battery, showing a field, the influence of which is exerted from left (+) to right (—). Immersed in this field is a secondary wire, insulated from and in no way connected with the first. To the ends of this secondary wire we attach a meter of the galvanometer type, which is most sensitive to slight modes. The needle of the meter in this secondary mode will be deflected to one side. Mark the direction. Now reverse the primary mode direction and immediately the needle of the meter swings over to the opposite side. Thus, reversing the primary reverses the secondary. Now connect the meter direct to the primary circuit, with the mode flowing in a known direction and you will get the deflection just the opposite to what it was when the meter was in the secondary circuit, with the primary flowing.

The secondary mode which is generated in the secondary wire, in the primary field, is called the *"induced mode"* and this process is known as *"induction."*

What is meant by electro-magnetic induction?

Electro-magnetic induction is a process similar to electric induction, by which is generated a magnetic field and lines of force, which influence a conductor immersed in the field, generating an induced mode in the parallel conductor. The combination of the two is known as electro-magnetic induction, and the combination greatly increases the potential of both, and the combined generator is known as an electro-magnet, and consists of a coil of insulated copper wire wound around an iron rod known as a "core," and forms the basis of the induction machine known as the faradic battery.

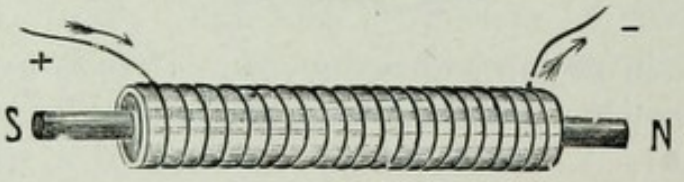
What is meant by hysteresis?

Hysteresis is a term applied to rapid magnetization and demagnetization of a soft iron core lying within a coil of insulated wire, through which an automatically interrupted galvanic mode is passing.

THE PRIMARY COIL

What is a primary coil?

A primary coil is one of coarse wire, wound about a cylinder, called a helix, through which a galvanic mode is caused to pass interruptedly for the purpose of inducing hysteresis in a bundle of soft iron rods within the helix, called a core.



Thus we see, by the accompanying sketch, where a bundle of iron wires is immersed in a primary field. This bundle of iron wires, insulated from the coil of wire, is called a *"core."* The wire so wound about the core is called the *"primary coil."*

How is induction modified?

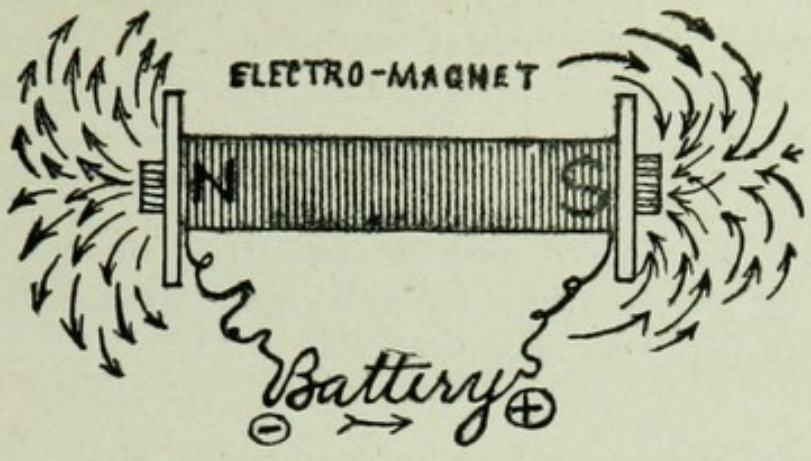
The induction is modified or varied by several factors:

First—By the strength of the primary mode.

Second—By the size of the primary wire.

Third—By the number of turns in the primary coil.

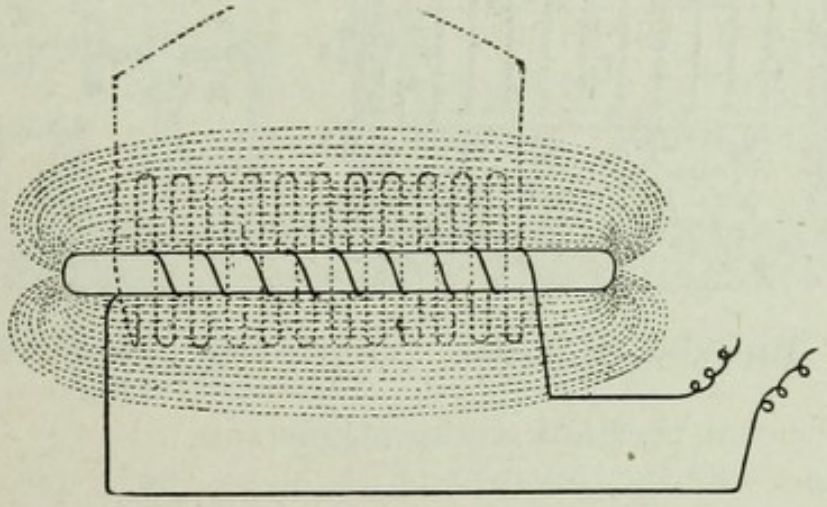
Fourth—By the length and thickness of the core.



THE SECONDARY COIL

What is a secondary coil?

A secondary coil is one of fine insulated wire outside of the primary coil. It is of great length, and the only mode that it carries is the one created by induction from the magnetized core and primary coil. Its mode is an alternating one, inasmuch as the mode induced by the "make" of the galvanic mode is in an opposite direction from the one induced at the "break" of the same.



The accompanying sketch shows a core, primary coil, field and secondary coil. The heavy lines represent the primary coil around the core, throwing out many lines of electro-magnetic force and generating a very strong *field*. The light dotted lines represent many turns of a secondary coil parallel to the primary coil and immersed in the strong field. This secondary coil cuts many more lines of force at right angles, and there is generated an induced secondary mode of very high voltage potential. The

longer the secondary, the more magnetic lines of force cut and the greater the inductive force, within the limit of saturation.

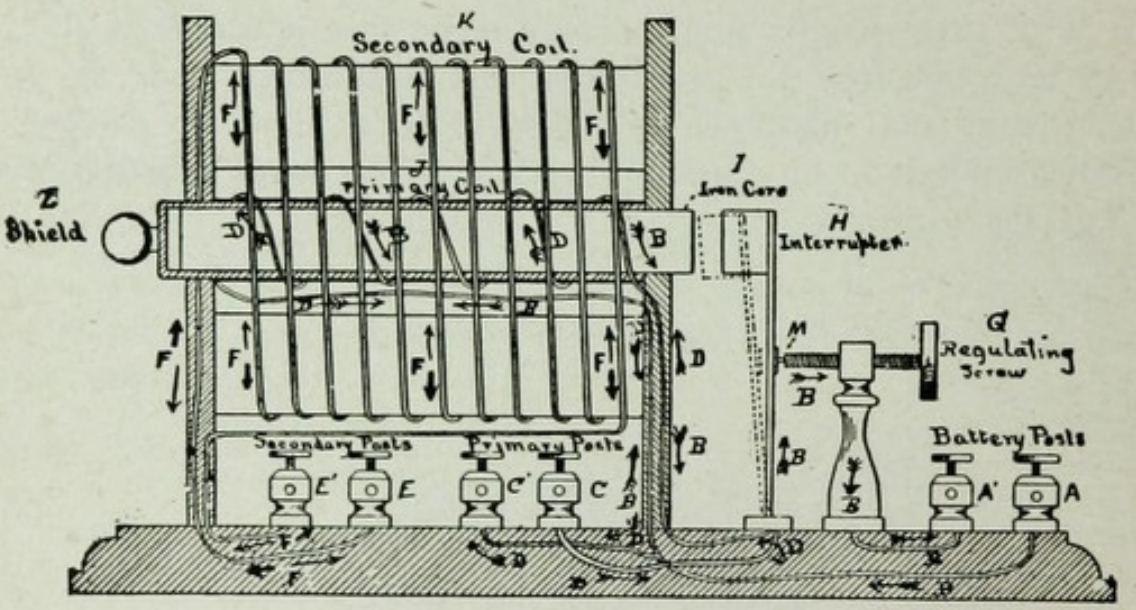
What is the limit of saturation?

There is a limit to the extent of the combination or electro-magnetic field beyond which the induced mode is not strong enough to overcome the resistance to the passage of the secondary mode through the secondary coil. This is called the *"limit of saturation."*

THE PHYSICIAN'S INDUCTION COIL

What are the essentials of a faradic battery?

The accompanying sketch shows a complete electro-therapeutic induction coil. It consists of the following essentials for the best results in therapeutics.



Working Diagram. Physicians Induction Coil

1. Some form of chemical or other generator.
2. A primary coil.
3. A soft iron temporary magnet, or core.
4. An interrupter or circuit-breaker (vibrator).
5. A secondary coil.
6. A means of varying the primary mode.
7. A means of varying the secondary mode.
8. Binding posts.
9. Electrodes and conducting cords.
10. A shield, or muffler (not absolutely essential).

What is the function of the vibrator and muffler?

The vibrator is in fact a rheotome, whose function it is to automatically interrupt the mode in the primary coil, thereby producing hysteresis in the soft iron core within the coil. The muffler's purpose is to restrict the extension of the electro-magnetic field into the substance of the secondary coil. The amount of restriction depends upon the degree to which the core is covered by the muffler. The muffler acts as a short circuit to the magnetic flux. It may be (and usually is) placed between the core and primary coil, in which position its restrictive influence is also felt upon the primary mode.

What is the nature and effect of faradic modes?

Faradic modes are of two kinds: primary and secondary. The primary mode is an interrupted constant mode or rather an interrupted galvanic mode, increased and modified in effect by the process of hysteresis going on in the central iron core. Its effects are superficial, and more painful than those of the secondary coil. The electrolytic and other chemical effects are so slight as to be of no consequence. It affects chiefly the superficial nerves and muscles.

The secondary mode is an interrupted, alternating, induced mode, created wholly through the inductive influence of the primary mode and hysteresis in the central iron core. Its effects are entirely mechanical and will extend to the deeper nerves and muscles. It is sedative and anæsthetic, and owing to its high voltage, it will penetrate deeply into the tissues.

VARIATIONS OF THE INDUCED MODE

How may the faradic mode be varied?

The secondary, induced or faradic mode may be modified or changed in the following various ways:

1. By the size and number of the cells.
2. By the size, length and number of turns in the primary.
3. By the rapidity of the interruptions at the vibrator.
4. By the muffler, in three places:
   (a) Between the core and primary.
   (b) Between the primary and secondary.
   (c) Outside the secondary.
5. By the kind, length and diameter of the core.
6. By the size, number of turns and length of the secondary coil,

which is still further regulated by the number of taps of the secondary at different lengths, or by the number of interchangeable secondaries.

7. By the distance the movable "sledge" secondary covers the primary.

8. By a shunt primary controller, if the street mode is used.

What can you say of the polarity of the faradic mode?

The primary mode from a faradic battery has the same polarity as any other constant mode of similar strength, except that it is interrupted. The secondary mode, being an alternating one, reverses polarity at each interruption, being in the opposite direction from that in the primary coil when the mode is "made," and in the same direction of that which flows in the primary coil when the "break" occurs. The "break" mode is somewhat the strongest.

THE SINUSOIDAL MODE

What is a sinusoidal mode?

A sinusoidal mode is an alternating mode whose alternations occur gradually, practically without interruption. The potential in one direction is gradually overcome, neutralized, and finally succeeded by an equal amount of potential in the opposite direction. These changes follow the line of a sine curve, when illustrated diagrammatically, hence the name.

What is the nature and effect of the sinusoidal mode?

The sinusoidal apparatus consists of a permanent magnet, between the poles of which an armature revolves, while a coil with a soft iron core is connected with each pole upon the outside. This mode produces physiological and therapeutic effects, which are not obtained by any other form of mode. The applications are painless, and afford excellent exercise to muscles, producing marked contractions without any other sensation than that of motion. The effects can be limited to a single muscle or set of muscles. When the machine is run slowly it produces interrupted contractions, and when run rapidly causes tonic or continuous contractions. This mode relieves pain and excites the nerves of special sense. Applied to the region of the eyes it causes luminous impressions, without any pain, prickling or the sensations that attend the galvanic or faradic mode. Applied

to ears, entirely deaf, from disease of the middle ear, sounds are heard. The sinusoidal mode is often anæsthetic when all other modes are not. The machine can be run by foot, water or electric motor power.

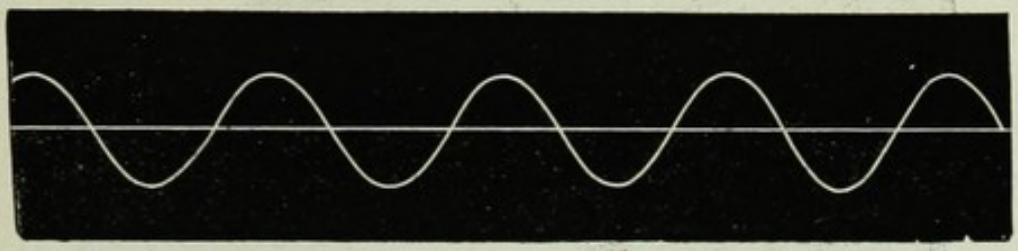


Fig. 1. Tracing made by mode from sinusoidal apparatus.

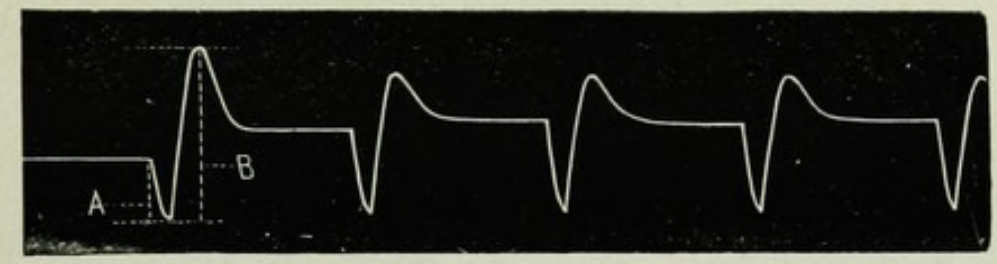


Fig. 2. Mode from faradic apparatus. A, make; B, break.

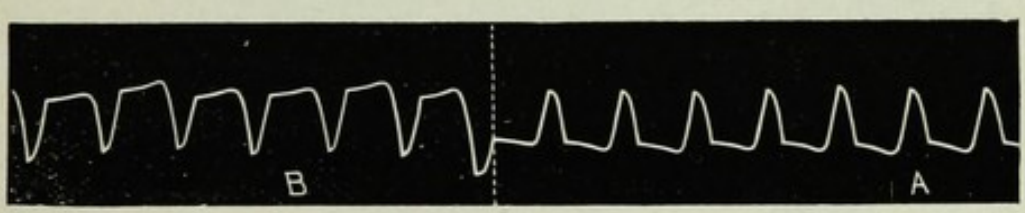
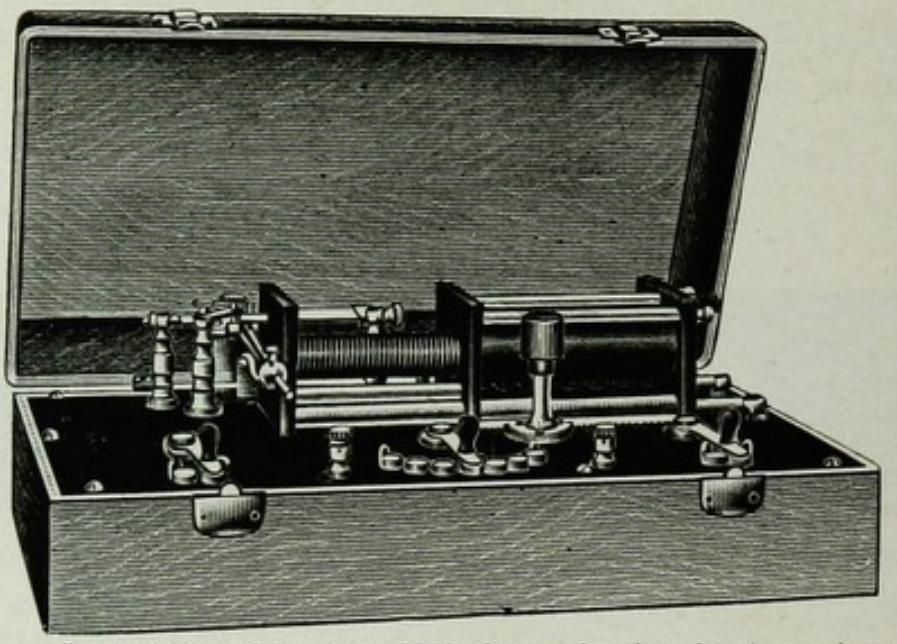


Fig. 3. A, mode from faradic apparatus. Same as Fig 2, but with different adjustment of rheotome. B, mode reversed.

What is the difference between sinusoidal and faradic modes?

The faradic mode, as distinguished from the sinusoidal mode described in answer to the preceding question, is an induced mode whose interruptions are abrupt, especially the one caused by the break in the primary mode, consequently the mode is accompanied by shocks, which may be severe and painful, if the mode is strong enough, and the interruptions come too slowly to produce tetanization of the nerves and muscles. The sinusoidal mode is painless in its passage through the tissues. Both modes are alternating, and hence devoid of polar effects.

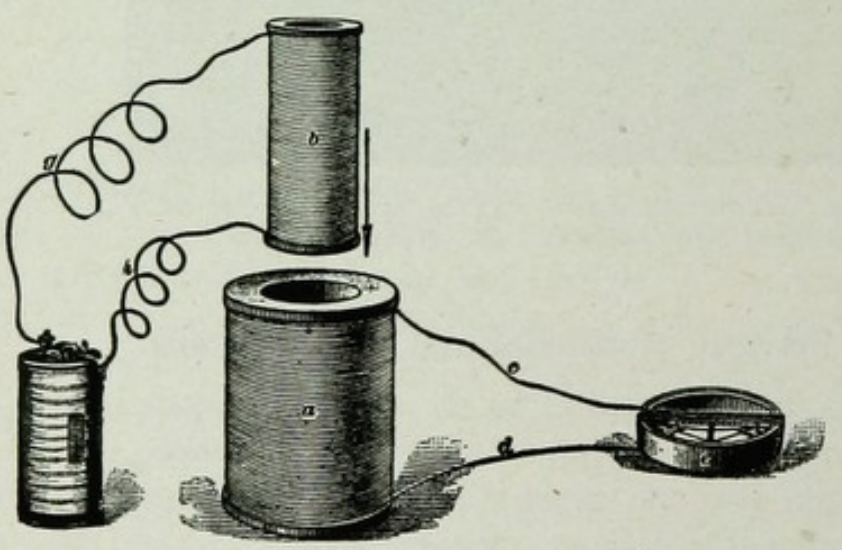


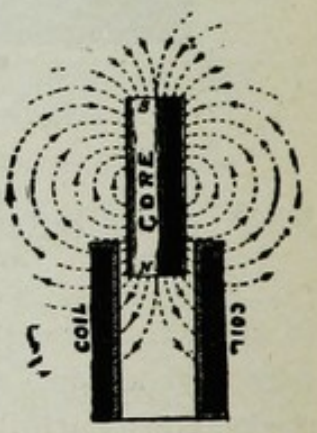
Secondary with over 7000 feet of wire in 4 sections. Any one or more can be used at one time. The first contains 900 feet of No. 30, second 1600 feet of No. 32, third 1500 feet No. 34, fourth 3000 feet No. 36.

SLEDGE TYPE FARADIC COIL BATTERY

What is a "sledge" coil?

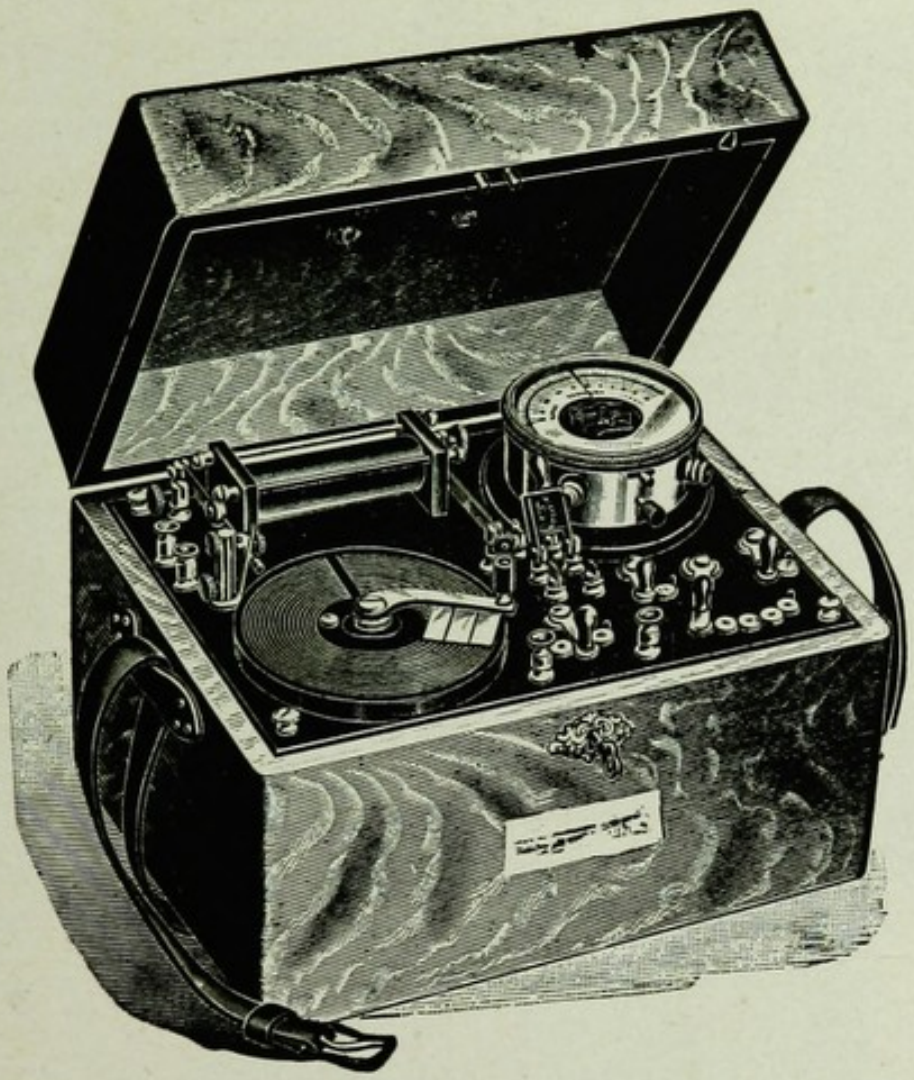
A sledge coil is a secondary coil which is made to slide on and off the primary coil, for the purpose of varying the strength of the mode which it carries. The mode is weakened by drawing it more or less from the magnetic field, and strengthened in the opposite way.





The accompanying cuts illustrate the complete separation of the core and primary connected to a galvanic cell, from the secondary connected to the meter. Simply lowering coil (b) inside the coil (a) starts the induction. This is shown in the left-hand cut. The small right-hand cut shows

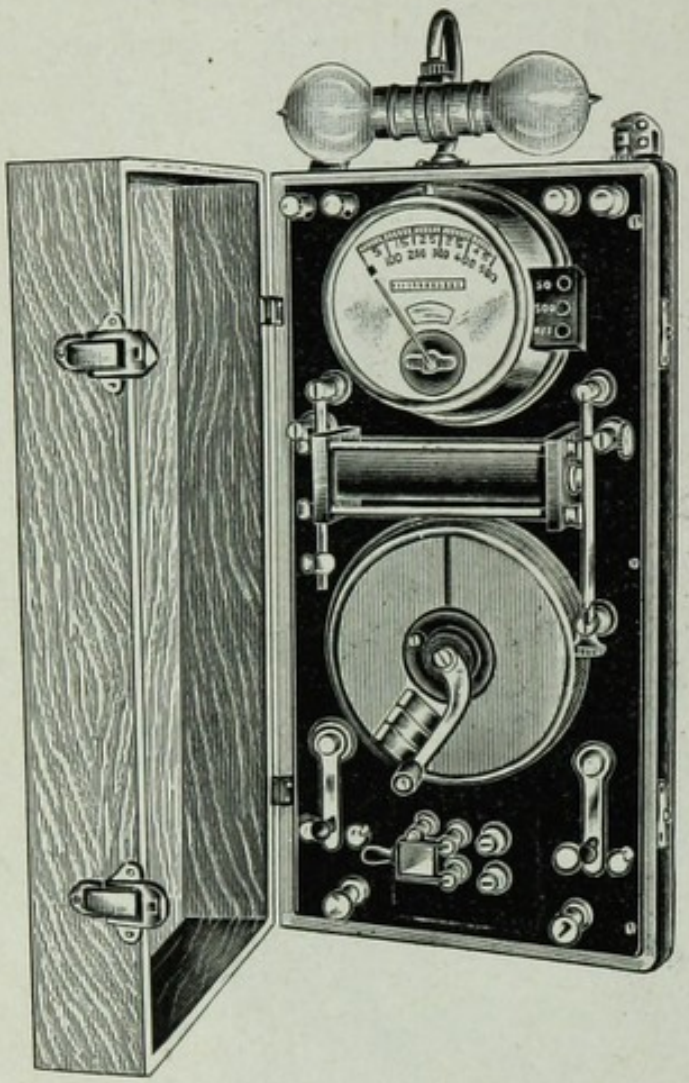
the lines of electro-magnetic force soaking through the outer end of the secondary coil. You can at once see how, by merely pushing the core and primary further into the secondary coil, that more turns are saturated, more lines of force cut and more induction and secondary mode is generated in the outer coil.



What is a combination battery?

The cut shows a new design for a combination of galvanic and faradic batteries, both in the same case, for convenience and portability. It can be used with a number of small dry cells or can be connected and used with the 110-volt direct incandescent light mode, only requiring a connecting cord and plug, to screw into a lamp socket at your office or at the patient's home. It consists of an improved double scale (0-20, 0-400) shunt milliampere meter, graphite rheostat, pole-changer and other necessary switches. The coil has both the hammer vibrator, with heavy ball attachment for slow vibration at one end, and a ribbon rapid vibrator or "singing rheotome," at the other. This gives a wide range of usefulness, both for office and out-

side work. The case is 10 x 11½ x 15 inches, and is strong, light, handsome and durable, with a carrying strap.



PORTABLE OR WALL BATTERY

The galvanic, faradic, separate or combined and sinusoidal if attached to any alternating lamp socket.

The milliamperemeter is shunt long and short scale 0-20, 0-500. The coil is double singing and ball vibrating. The rheostat is fire burned graphite.

Has pole changer, all necessary switches, cords, handle, series lamps, ready to attach to any 110 direct or cells.

If attached to alternating the faradic coil can be operated, also sinusoidal delivered but the faradic will not be as good as if operated by cells or direct. Can also be used with a rectifier.

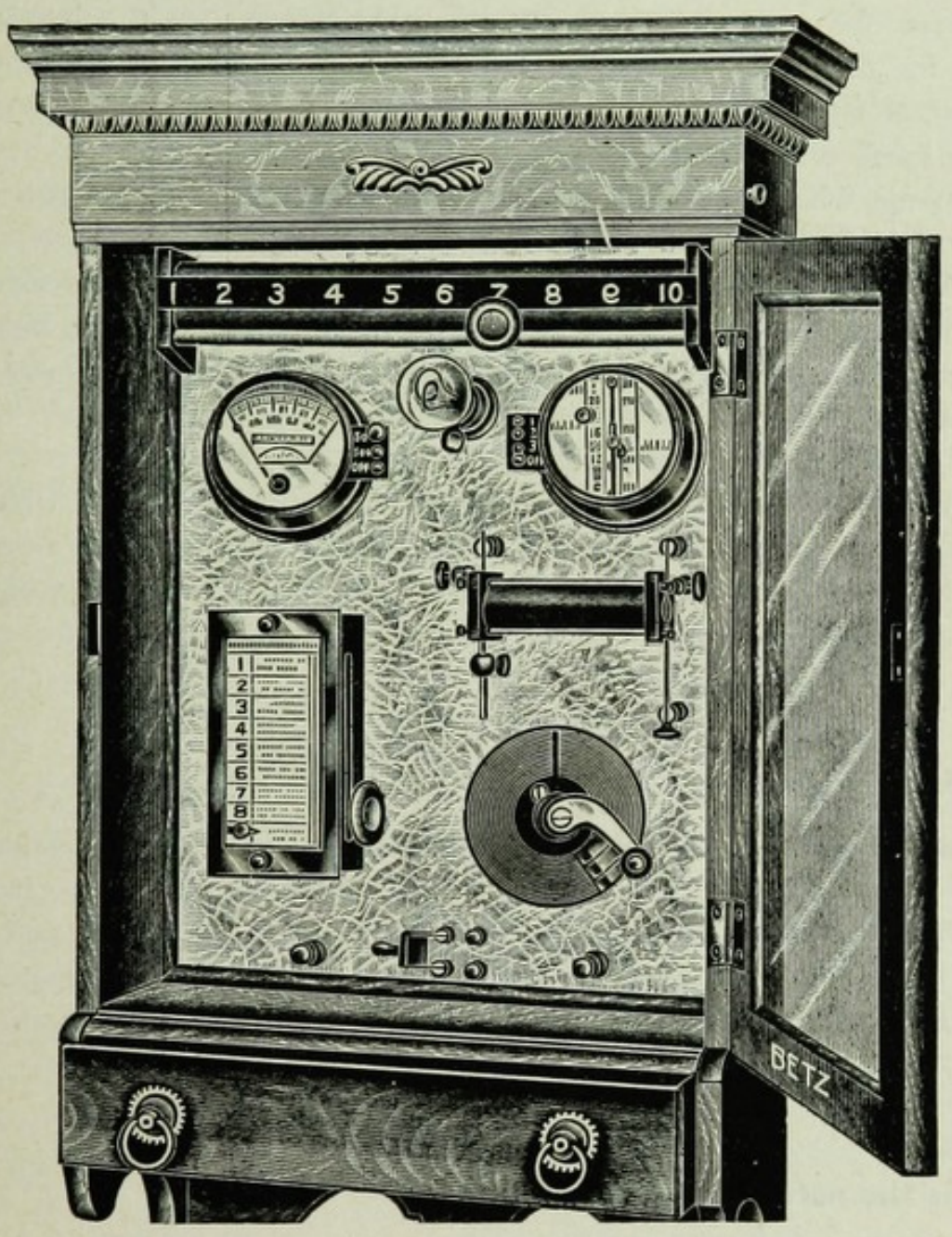
THE WALL PLATE

What is a wall plate?

Many physicians want some apparatus for the practice of electrotherapeutics, which will be complete, well made and reliable, compact, ornamental and attractive, at the same time reasonable in price. The plate shown herewith contains the essentials. It is mounted in a handsome well-made oak, imitation rosewood, or white enamel case, to be attached to the wall, with glass front door and sides, and a drawer below for electrodes, and a shelf above. The cells may be in an adjoining room, or in some convenient closet, or in the attic or cellar, or if the street mode is used, the wires are easily attached and concealed.

When closed it adds to the appearance of the room, and the different

parts are protected from dust and moisture. When open it is ready for use at a moment's notice. The plate contains a long fine wire high tension faradic coil, with a fine and coarse interrupter, also double singing ribbon and ball vibrator, giving a great variety of effects. The graphite rheostat, which is the best kind, will safely and surely control either the galvanic,



faradic or combined modes so that the operator may give any dosage from the mildest to the full capacity of the battery without danger of shock.

The shunt milliampere meter is the most important part, as it measures the dose. It has a long scale for heavy doses, registering from 0 to 500 ma., a short scale for light doses, from 0 to 50 ma. You always should know

the amount of mode passing all the time. The rheotome gives various interruptions of either, from 8 to 600 per minute. It is automatic, and has a scale on the face with guide to set the ball on the pendulum so as to get any desired number of interruptions.

At the top of the battery is the regulator for raising or lowering the voltage or amperage while the battery is in use.

There are no switches except the pole changer at the bottom of the cabinet for throwing positive or negative to either electrode. Operated by cells, direct street mode or by using a rectifier the alternating street mode may be used, which will also give the sinusoidal mode.

Anyone who can read galvanic, faradic, sinusoidal, etc., can place the finger of the indicator on the dial of the selector and operate it.

The whole is simple and easily operated, and will not get out or order. This wall plate is not intended for diagnostic or cautery work, but for general electro-therapeutics, and aside from the fact that in neatness and elegance the outfit leaves nothing to be desired it is guaranteed to be substantial, and will give many years' service.

The marble slab is 18 x 24 inches. The cabinet is 22 x 37 inches with door and drawer for holding electrodes. One pair of cords, one pair of hand electrodes, one foot plate go with each case. Shipping weight about 150 pounds.

What is a dynamo?

A dynamo is a machine for the purpose of generating a mode of electrification. It consists of a revolving part, called an armature, from which a mode is conducted to the wires leading from the dynamo, and which is induced in the coil contained in the armature, by the revolution of the armature between the poles of a magnet, which constitutes a part of the dynamo.

What is the nature of a dynamo mode?

A mode generated by a dynamo is made up a large number of impulses caused by the armature passing the magnet as the armature is revolved. When a commutator is used on the dynamo these impulses all flow in the same direction in the line wires; and this is called a *direct* mode; but when no commutator is used, the impulse travels out on one line wire, and when the armature has traveled one half revolution, the impulse travels out over the

other line wire, or in other words, these impulses change the direction in the line wire to the opposite direction each half revolution of the armature. If you number these impulses, the even numbers will all travel in one direction and the odd numbers will all travel in the opposite direction in the line wires. This is called *an alternating mode.* Each impulse is called an alternation. Two consecutive alternations are called a *cycle.* The ordinary alternating mode has 60 cycles a second, or 7,200 alternations per minute.

The constant mode generated by a dynamo or storage battery differs in action in no essential particular from the constant or galvanic mode produced by chemical action in some one or other of the many forms of galvanic cells customarily used by physicians, while the electro-motive force is, as a rule, much less variable. The advantage to the physician of having a supply from a central station and thereby freeing him from the innumerable annoyances inseparable from the attempt to keep a series of primary batteries in efficient working condition, can be readily seen and appreciated by all who have worked in this field. If, then, incandescent light or dynamo modes used for propelling street cars or running other motors were accessible to all physicians, it has occurred to many that electro-therapeutic apparatus might be greatly simplified, for then provision for controlling and adapting them to the physician's work would alone be needed.

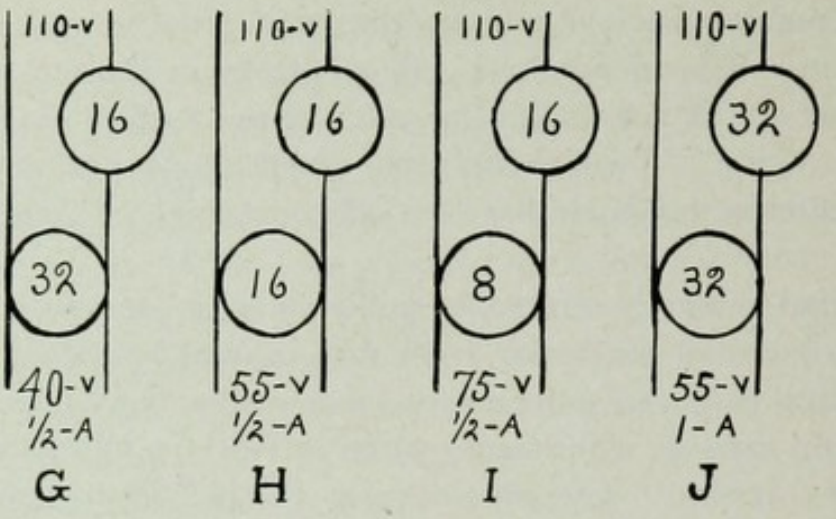
What commercial modes are to be used?

There are two modes of commercial power available for therapeutics. One is the direct, the other the alternated.

The direct mode is usually delivered in three voltages, viz: 110 v., 220 v., and 500 v.

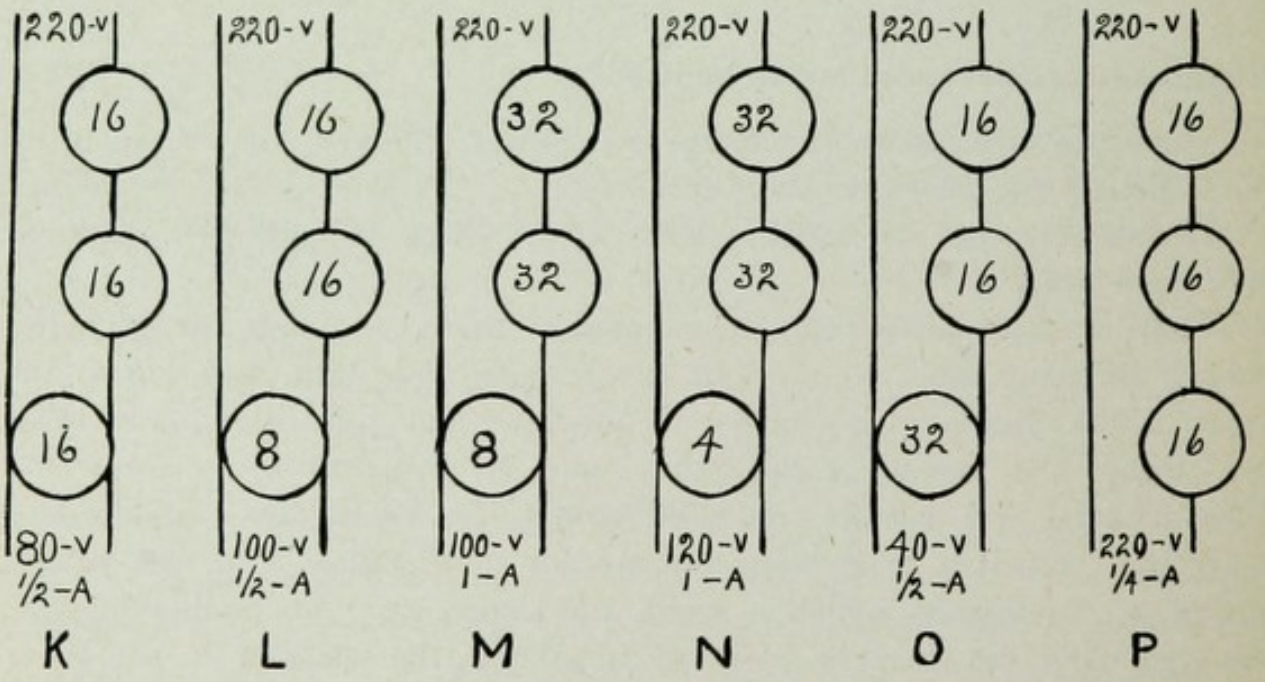
The one most universally distributed is the 110 v., but this is being changed in many cities to the 110 v. alternated for light, and 220 v. for power, as the alternated is cheaper to generate, and gives less loss in leakage. Either the 110 v. or the 220 v. may be transformed by means of lamps in series and parallel, and used with safety. The 500 v. mode may also be used, but it is dangerous, and not advisable, unless it be first passed through a transformer, which is large and expensive. The following diagrams showing the ways to wire lamps will aid the operator to use these modes in his work. Any local electrician will readily translate the drawings and mount the lamps for you, if you cannot or do not care to do it yourself. The insurance regulations are strict, and it is advisable to have it done by a commercial expert.

How may we use the 110 v. direct mode?



The drawings "G," "H," "I," "J" show how to wire 110-volt lamps so as to use the 110-v. direct mode. One lamp is wired in series, and the other in parallel. The figures in the circles representing the lamps indicate the candle-power of the lamps used, and the figures at the bottom, above the letters, indicate the approximate voltages and amperages delivered.

How may we use the 220 v. direct mode?

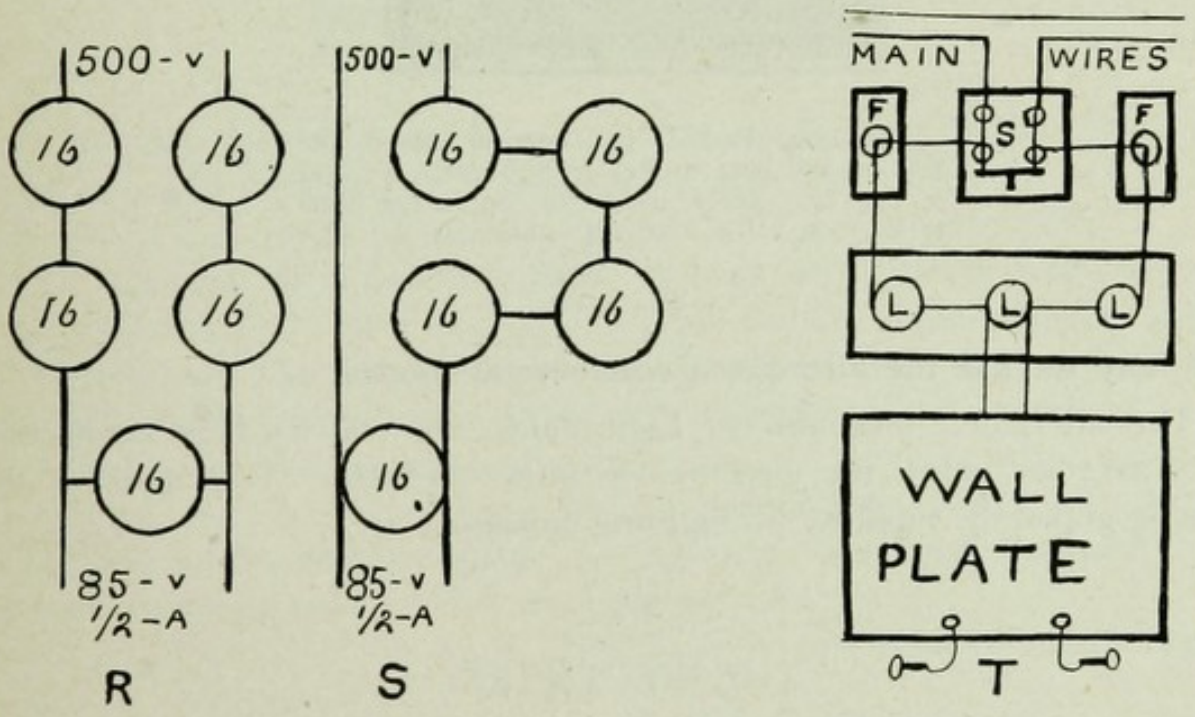


The drawings "K," "L," "M," "N," "O," "P" show how to wire 110-volt lamps so as to use the 220-v. direct mode.

Two lamps are wired in series and one in parallel. The figures in the

circles representing the lamps, indicate the candle-power of the lamps used, and the figures at the bottom, above the letters, indicate the approximate voltages and amperages delivered.

Experience has shown the author that for the ordinary wall plate cabinet which is described in this book, when used with the 110-v. mode, the wiring shown in "G" is best for mild doses, and "J" for heavy work. When using the 220-v. mode, experience shows that for mild dosage the wiring shown in "K" is best, and for very mild dosage, such as used in hair work, then "O" is best, but for the average run of treatments the wiring of "M" is most satisfactory. The sinusoidal generator in the large specialists' cabinet will not run well with a potential of less than 100 volts, and "M" is the one I use. If more voltage is desired, then use "N," but the 4-candlepower lamp will soon burn out. When "M" is used the two 32-candlepower lamps will glow a dull red, and the 8-candlepower lamp will light up brilliantly. This wiring, in combination with the regulator at the top of the plate, gives entire satisfaction.

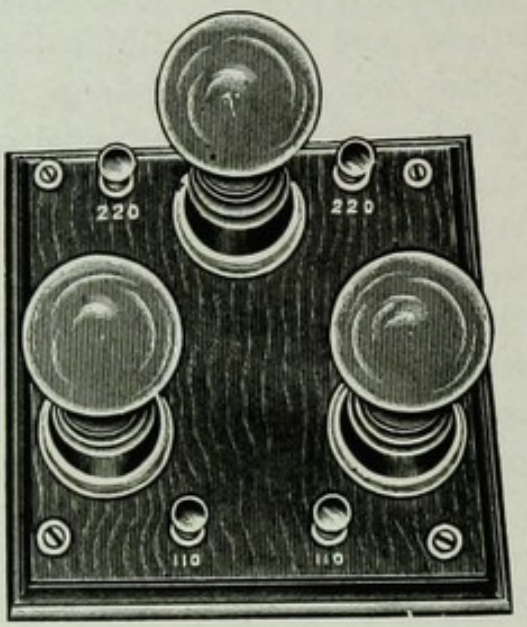


How may we use the 500 v. direct mode?

The drawings "R" and "S" show how to wire 110-volt lamps so as to use the 500-v. direct mode. Here four 16-candle-power lamps are wired in series, and one in parallel, giving approximately 85 volts and ½ ampere below. As stated before, this mode is dangerous to handle, and not advisable.

How should the apparatus be connected?

The drawing "T" shows how the main wires from the street service should be connected, viz.: first to a single throw, double-pole knife switch, "S"; thence to two single or one double, Edison, cut-out fuse plug blocks, "F-F"; thence to the bank of series and parallel lamps, "L-L-L"; thence to the wall plate or cabinet; thence to the patient, "T."



Reducing Board, for cutting down the 220 or 500 volt modes to 110 volts so that it can be safely used for operating batteries, etc., for treating patients.

How may we use the alternated commercial mode?

The alternated incandescent light mode may be used in connection with a rectifier, when the direct mode is not avilable. This mode is the one now generally supplied for lighting purposes.

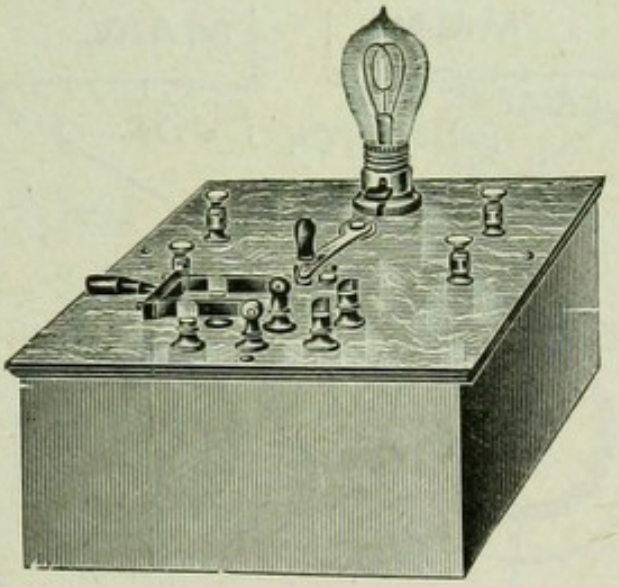
THE RECTIFIER

What is a rectifier, and its uses?

A rectifier is an apparatus by means of which it is possible to so change or transform an alternated commercial mode, as to make of it a direct or unidirectional mode, which may be used for electrolytic work. It will not, however, remove entirely the pulsating character of the mode, and therefore is not to be advised for delicate operations about the face, such as the removal of hairs and small facial blemishes.

Many claim the galvanic mode secured by first passing the alternating through the rectifier, is equal to cells or direct mode for the treatment of patients. This is not true.

For the ordinary run of electro-therapeutic work the rectifier can be used in connection with the alternated mode. Neither a direct or a rectified alternated mode is as mild or as good in effect as the true galvanic mode which is derived from the chemical cells of a battery.



The accompanying cut shows the common form of rectifier, with four aluminum cells arranged in a quadrangle, although they may be arranged in a row, if more convenient, to place on top of a wall plate case.

By passing the alternating mode through the rectifier it will operate a galvanic battery. By throwing the knife switch to the opposite side of the rectifier and passing the direct mode to the galvanic side of the battery you have the sinusoidal mode. This will also operate the faradic.

There are several kinds of rectifiers, as the magnetic, inductive, mechanical and electrolytic, but the last named kind is the best, because it is the most reliable, simplest and cheapest, and most economical, and having no moving parts, will not get out of order.

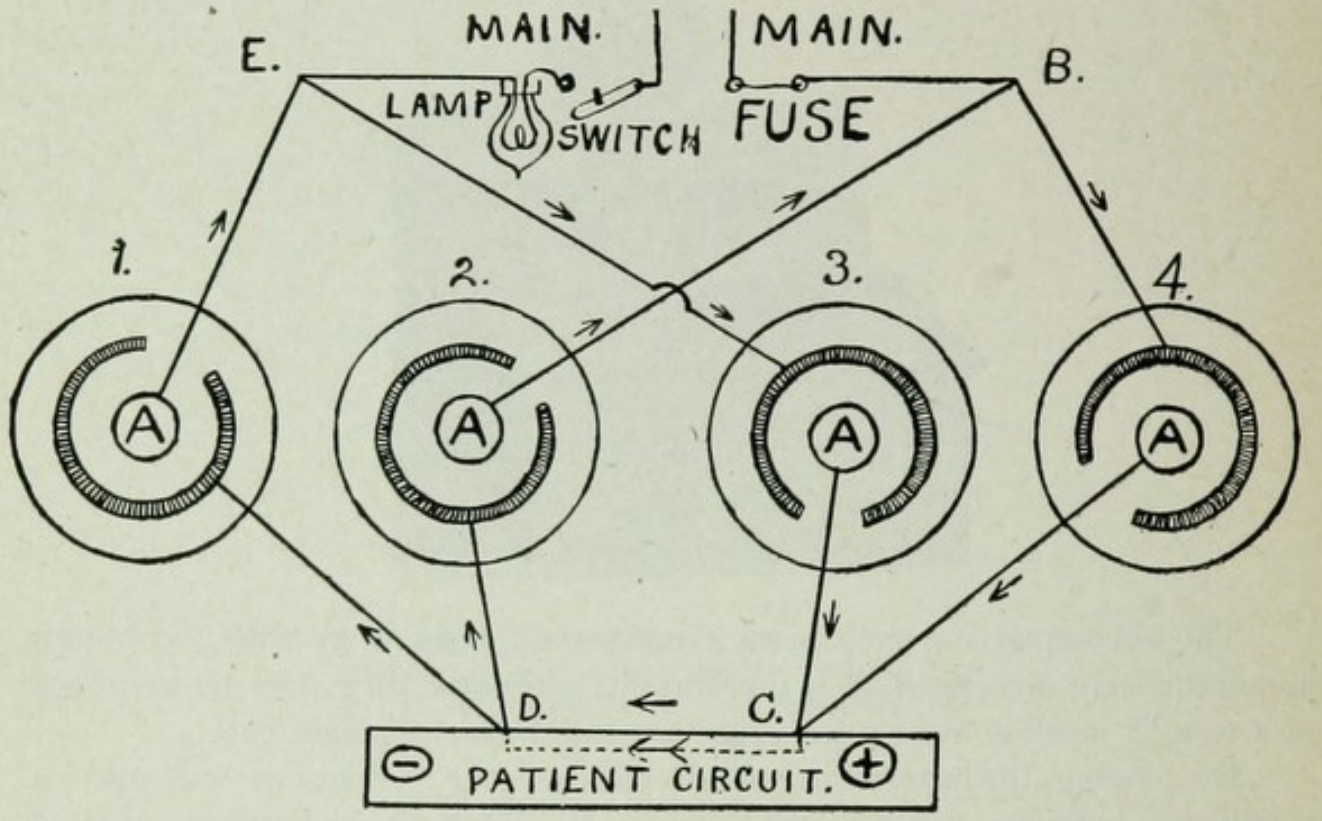
They are called aluminum cells, because one element of the cell is made of aluminum.

The practical value of the rectifier depends on the peculiar property possessed by aluminum, in that it will offer a very high resistance to the passage of the mode, when it is so placed as to be the anode of the cell, but does not so act when placed so as to be the cathode in the cell.

This disposition of the cells was arranged by Grætz, and is an application of what is known as the Wheatstone bridge.

If we pass an alternated mode through an aluminum cell, as mentioned

above, we will have an almost complete and instantaneous arrest of an impulse in one direction, but there will be no change in the impulse in the alternate direction, and we would have an interrupted mode, and it is on this basis that the four cells of the rectifier shown in the accompanying cut are grouped so as to lead all the impulses of both alternations in the same direction, and deliver a continuous mode.



PLAN OF WIRING OF ALUMINUM FOUR CELL RECTIFIER.

An alternating mode is positive first on one lead, then the other; the rectifier will allow mode to pass only in the direction indicated by the arrows; therefore, by tracing the wiring as the arrows point you will see how both waves of the mode must pass through the apparatus over the plus (+) wire, making it unidirectional.

The diagrams (page 131), A, B, C and D, show the connections of a three and four-cell instrument for both the two and three-wire service.

Some power plants prefer to use the three-wire system, so as to better balance their load; figures C and D show how we block the plus wave on the two outside wires, causing the true unidirectional mode to pass through the coil over the "neutral" wire, returning to the outside wire alternately as indicated by the arrows.

Show these diagrams to the superintendent of your central power station, and he will tell you which form of wiring is best suited for the primary mode supply at your command, and he will doubtless see to it that you are supplied with sufficient mode.

The most efficient generators on the market require 40 amperes at 110 volts for quick picture work; therefore, if you cannot get as much mode you will not be able to make good X-ray pictures with any kind of apparatus.

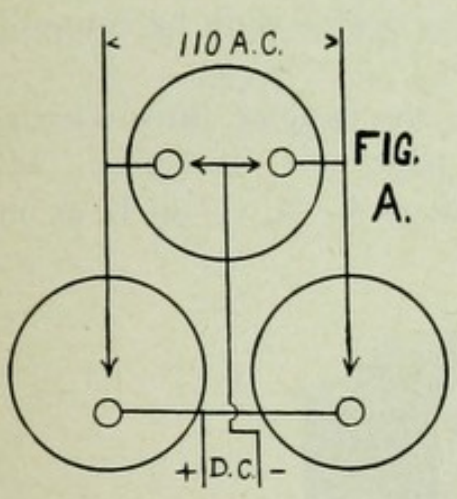


FIG. A.

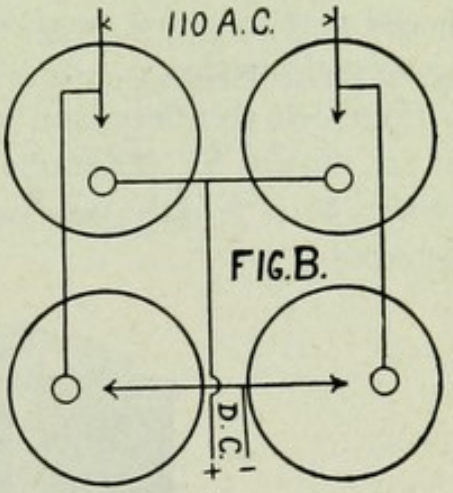


FIG.B.

Copyright 1911, J. Robert Kelley, Covington, Ky.

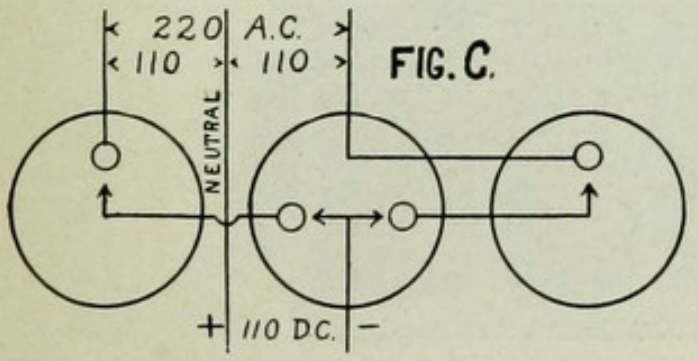


FIG. C.

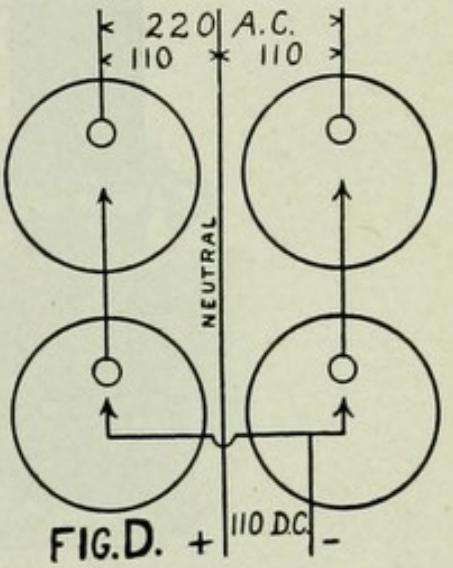


FIG. D.

The secret of success in making good X-ray pictures from either direct or rectified alternating mode is to have a primary mode supply of not less than 40 amperes for a period of 20 seconds at a normal pressure of 110 volts.

The key to the situation is—if mode is direct, the lead wires between your supply dynamo and your coil must be of sufficient size, depending upon distance and other local conditions.

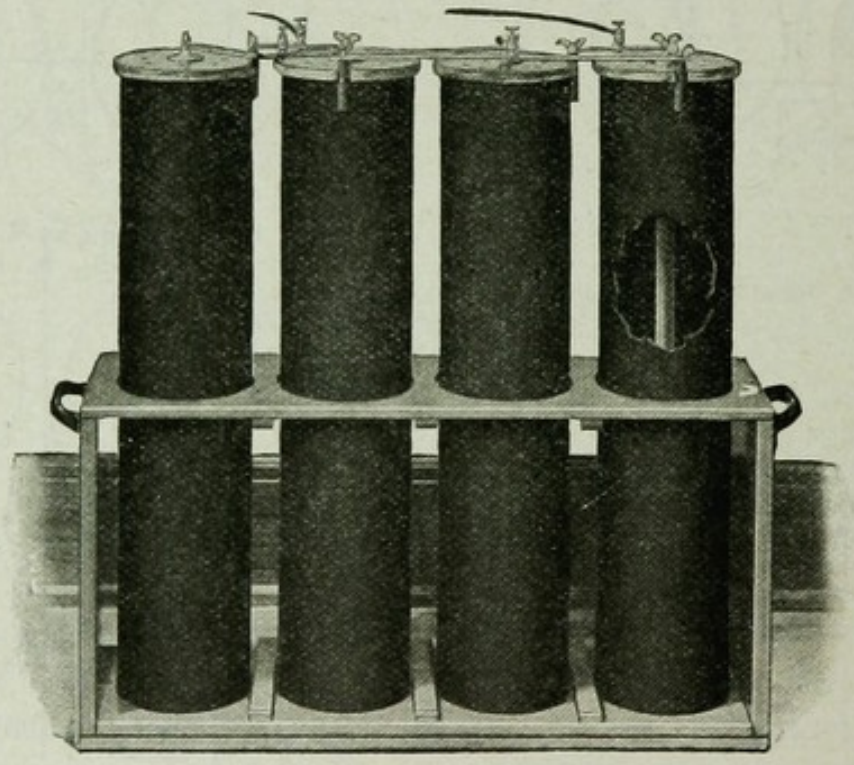
If mode is alternating, the high-tension mains should connect with

a step-down feed transformer of proper size located within a few hundred feet of your coil installation, having No. 6 lead-in wires, or larger, otherwise the voltage will not remain normal when drawing 40 amperes.

This requirement is not excessive; such a mode should be available in any locality where electric lights are used; if not, your service is insufficient or defective. From 3 to 10 amperes will do for treatments but not for picture work.

Three cell rectifiers can be wired for either two or three wire systems, as shown by diagrams Fig. A and Fig. C on page 131. It will be observed that by either method one cell performs double duty by containing two valve electrodes.

Four cell rectifiers can be wired for either the two- or three-wire system as shown by diagrams B and D on page 131, therefore, when ordering it, it is only necessary to state rectifier, A, B, C, or D as may be selected.

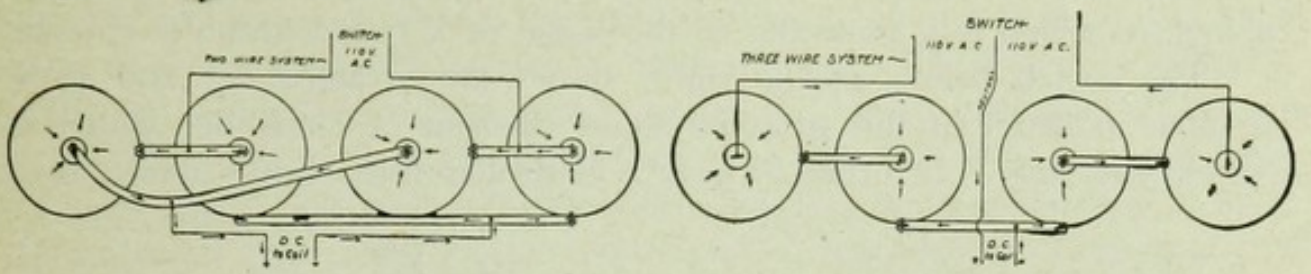


The Giant A. C. Rectifier.

The elements of this rectifier are immersed in fourteen gallons of liquid. In this the pure lead cylinders serve the double purpose of electrolyte container and positive electrode for each cell, thereby distributing the mode evenly over the whole length of the long round valve cylinder throughout its length.

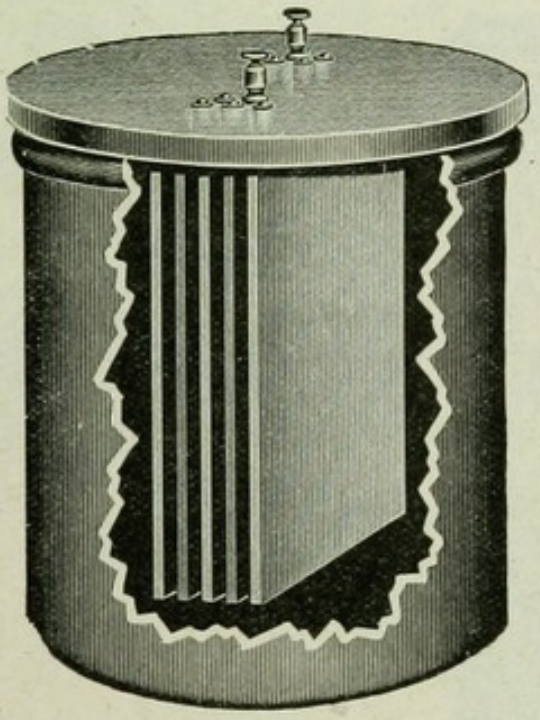
The diagrams show the connections for both the two and three wire 110 volt service, and when ordering, state which system is to be used.

The superintendent of your electric light plant will tell you which you have. If you should have the 220 volt service, the connection shown in diagram, Fig. "D," shown on page 131, may be used, without lowering the



efficiency, or overheating, and by this method may be attached to the cells for hours, without noise or injury. This rectifier occupies a floor space only 9 x 31 in.; height 32 in.

LARGE ONE CELL RECTIFIER

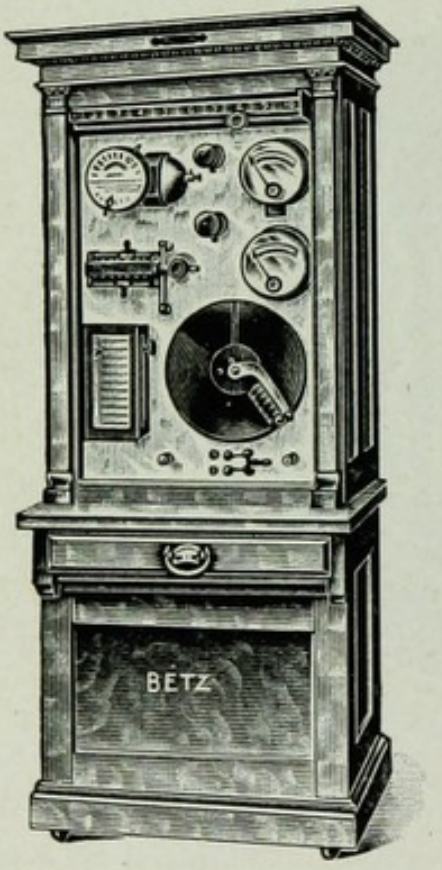


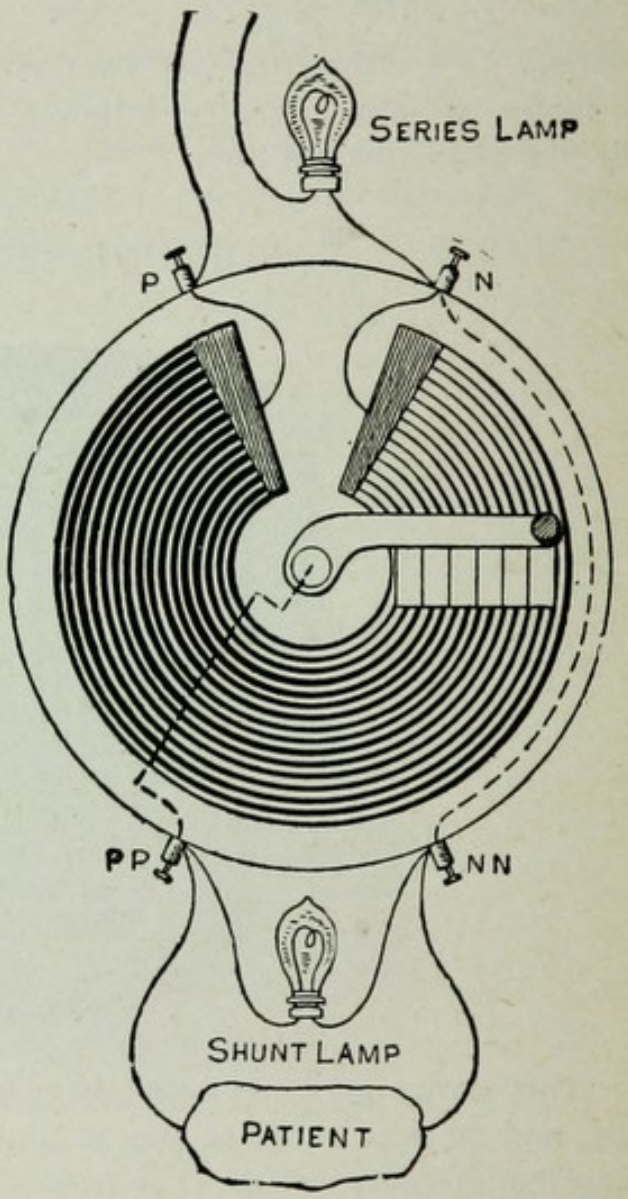
This shows a rectifier consisting of one cell only, for use with X-ray coils, and storage cells for use in automobiles, dental engines etc. When using the alternated mode, it is necessary to rectify or change it to a direct mode, before passing it to the electrolytic interrupter, and it is a great economy of energy as well as space to have the rectifier all in one cell rather than in a number of them. This jar holds five gallons of the electrolyte, and the active or working surface of the lead and aluminum electrodes is very large. This is adapted to use with both large and small apparatus, and for heavy and light work, and has a special cooling device which prevents overheating, which adds greatly to its efficiency.

What is a controller, and its uses?

The cut below, at the left, shows a complete electro-therapeutic cabinet, in which is a controller in the shape of a round graphite rheostat.

The sketch below, at the right, shows the arrangement and working plan in detail of this graphite shunt rheostat or controller which we will explain fully. In order to have a controller for a heavy mode, so as





to be able to administer large doses, such as are necessary in the phoric treatment of cancers and other growths, the rheostat is enlarged, till the graphite surface is twelve inches in diameter. This adds a wider range of resistance and will allow a fractional and perfectly smooth reduction of resistance, and consequent increment of electrification passing, with a range of dosage from a mere fraction of a milliampere, up to as high as

1500 milliamperes, if desired. It may be used with either the 110 or 220 volt direct street mode, or a battery of primary cells.

But when we use very slight modes, we should have correspondingly low voltage, so as to lessen the painful effects, when removing hairs, or when working about the organs of special sense. Therefore, in order to adapt this controller to the street mode, the shunt principle of control (which has been fully explained before) has been added to this controller. By referring to the sketch below and following this explanation of it, it will be made clear. First, you will notice an incandescent lamp is placed in series with the negative main and connected to the post N. This adds resistance and according to Ohm's law, reduces the amperage. The other street main is attached to the post marked P. These posts connect with the graphite surface of the rheostat, and the main mode passes around through the graphite, shown by the concentric circles, and out through the series lamp. Then, if the patient's circuit be connected to post marked P P and N N, we know that the patient will be *in shunt.* The meter should be in the patient's circuit. So far the new controller is just the same as the ordinary shunt wired graphite rheostat, and differs from it in no respect except in size. The improvement lies in the addition of another wire from N to N N, which is then connected to a second incandescent lamp, *in series* with post marked P P, which is connected by a wire, shown as the dotted lines, from post P P, to the pivotal end of the sliding contact switch. This arrangement puts the patient still furher removed from the primary mains, and makes the patient's circuit really a double shunt, or a shunt within a shunt. This makes the voltage and amperage still more reduced. The milliampere meter should be placed in this secondary patient's shunt circuit, so that it will measure only the electrification flowing through the patient, and not the mode passing through the lamp also. By his arrangement, the most of the voltage is used in the lamp circuit, which is a better conductor than the body of the patient. Therefore, the patient gets a small dose under diminished pressure.

Now if the key of this lamp is turned on, and the rheostat switch arm moved over the graphite, the electrification will traverse the three tracks shown in the sketch above, and be distributed proportionally, according to their several resistances. Thus, so small a mode will pass through the patient that the large switch arm will have to move half way around to get the patient's meter to register one milliampere, while the shunt lamp will glow a dull red. This very gradual increase very much lessens the disagreeable sensation, and there is a marked difference in the feeling of the passage of two or three milliamperes, under a full 110 volts, and the

same dose under the greatly reduced voltage of this secondary shunt circuit. In the cut of the plate, page 137, this rheostat is shown at the bottom of the plate, with the two lamps above, the *one in shunt,* the *other in series,* as shown in the sketch at the right. The one in series is to cut out part of the amperage and protect the graphite from burning. This series lamp may be cut out of the circuit if desired, and thus enable an *expert* to utilize the full potential of the street mains, in series circuit only, for giving very heavy modes.

When both lamps are in use, as shown in sketch, the patient's dose may be made very small, and be almost identical with the galvanic mode from a primary battery. With both lamps off, you get the effects of the dynamo mode, with series control, and it can be used with either the direct mode for electrolytic and phoric heavy work, or for controlling the faradic secondary induced or the sinusoidal modes, in therapeutics.

With both lamps on, and the meter and patient cut out of the circuit, the patient's secondary shunt circuit mode is adapted for use in lighting small power diagnostic lamps, for exploring and illuminating cavities. A large battery of primary galvanic cells may be used with this cabinet and controller, as well as the street mode. This controller may be had also in portable form, mounted in a separate receptacle, so that it may be transported easily, and used in connection with some other source of power, as occasion may require. We believe that this new controller answers all requirements for the safe, successful and satisfactory control and use of what is otherwise a sometimes disagreeable and dangerous mode.

By aid of this device the physician may utilize the 110 or 220 volt direct or constant dynamo mode for therapeutic work—*electrolytic work.*

Or by aid of this device the physician can utilize the 52 volt or 104 volt alternating dynamo mode for therapeutic work—*faradization.*

THE POPE-JUETTNER-BENNETT GALVANIC, FARADIC AND SINUSOIDAL CABINET

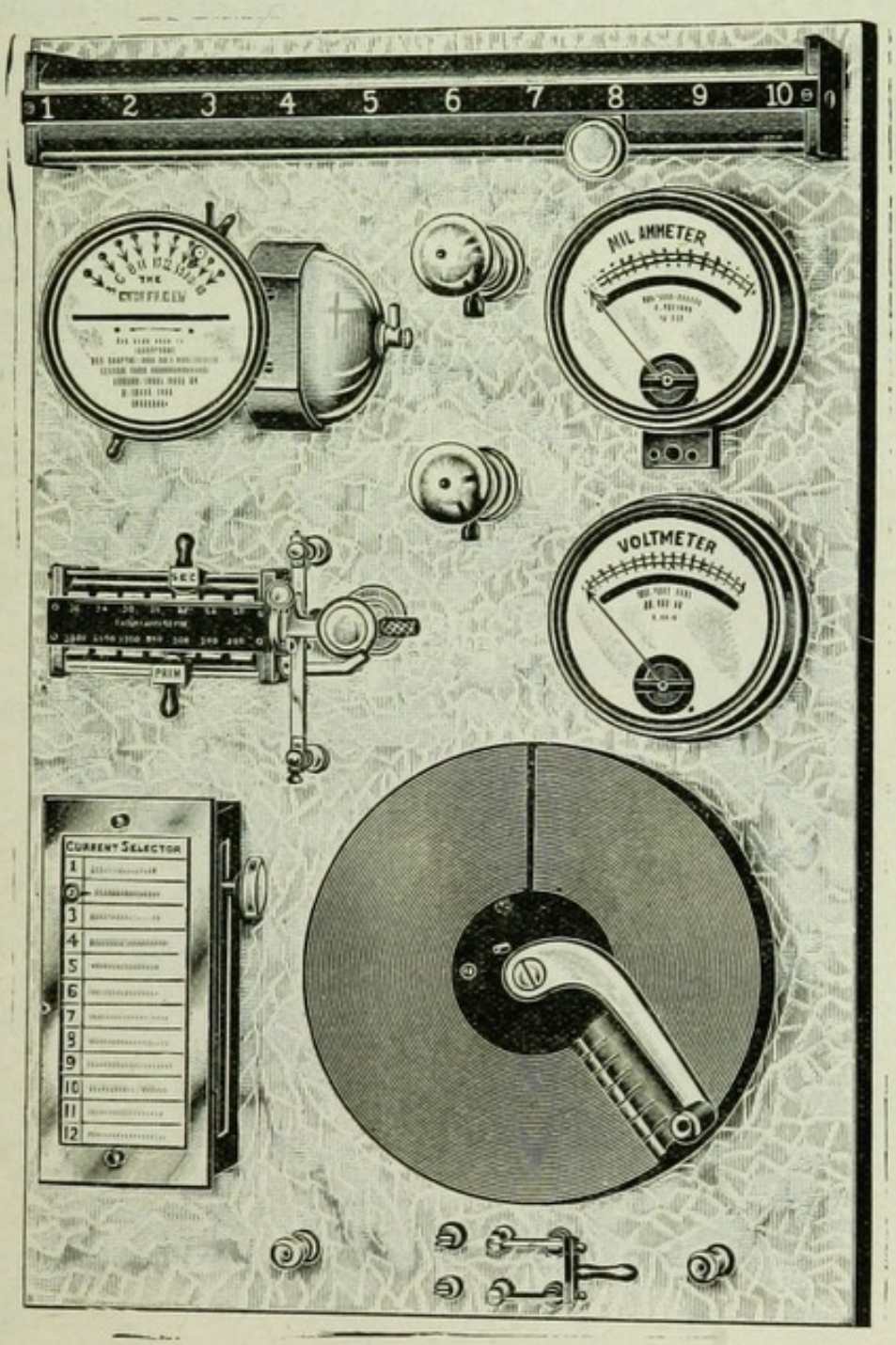
The milliampere meter is of low resistance variety, and is known as the "dead-beat instrument." This means that the needle at once stops at the proper mark indicated by the mode and does not flutter, as do the ordinary meters. This effects a saving of valuable time when operating. It reads from 0 to 30 milliamperes on the upper scale and from 0 to 1,500 milliamperes on the lower or shunt scale.

When treating cancers and tumors a milliampere meter measuring up to 1,500 milliamperes must be used.

There is also attached a volt meter which will give a correct reading

of the voltage in use. This meter will register from 0 to 125 volts in one-volt divisions.

The shunt graphite rheostat or controller which has been previously described measures 12 inches in diameter and is adjusted so finely that it will absolutely control any mode from the mildest up to the full capacity,



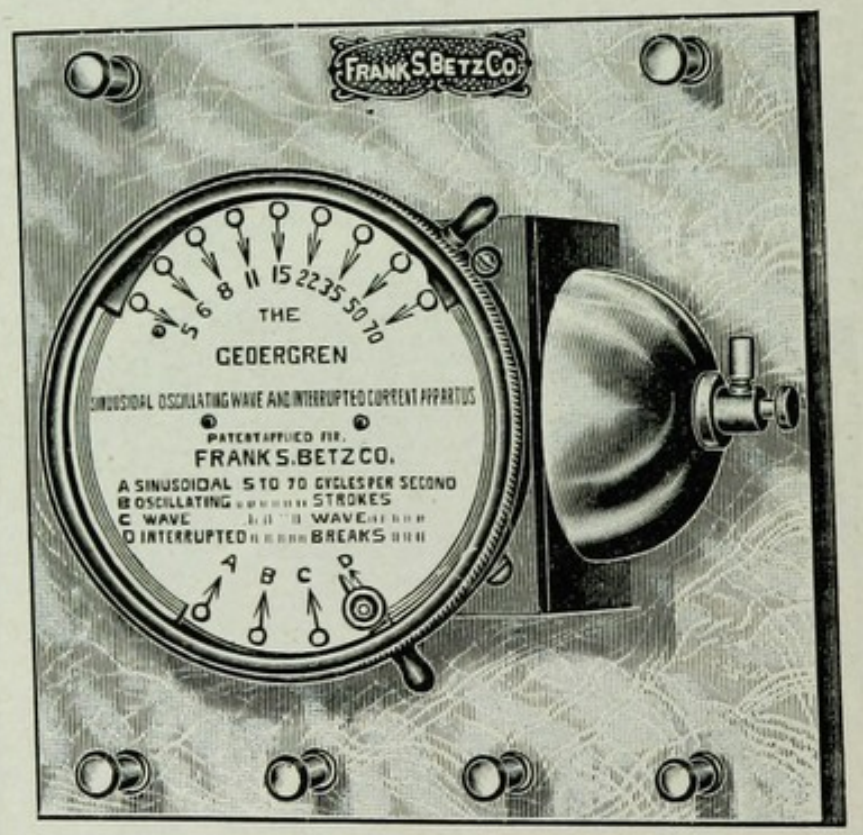
which is about 2,000 milliamperes. These heavy doses are used in treating cancers and tumors.

At the top is the amperage and voltage regulator. Just below and at the right are the milliamperemeter and voltmeter, one below the

other. On the left is the combination sinusoidal, oscillating, wave and interrupted mode generator, which will be described fully. Just below this to the left is the compound induction coil, which will be also more fully described. Below this to the right is the large controller, which has been fully detailed, and to the left is the new mode selecter, which does away with all the old style multiplicity of switches. The only switch is the pole-changer at the bottom. The two lamps are described in connection with the controller, mentioned before.

This cabinet is not to be operated by cells, but with either the 110 or 220 volt direct street mode or the rectified alternated street mode.

The cabinet is beautifully designed and made of thoroughly kiln-dried quarter-sawed oak, hand-rubbed and polished, and special care has been taken to make it free from all joints and all gingerbread work and perfectly plain, so that it can be easily kept free from dust by simply wiping with dry cloth. It stands 69 inches, is 26 inches wide and 22 inches deep, and will weigh, boxed for shipment, about 400 pounds.



The polished marble slab upon which the essentials of this magnificent cabinet battery are attached, measures 24 inches wide by 36 inches high and is 1⅛ inches thick, and attention has been given to have it free from all imperfections.

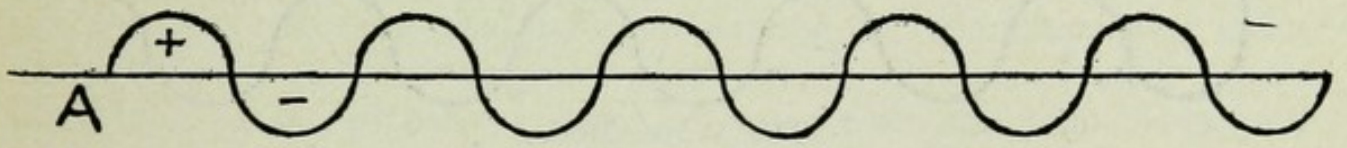
SINUSOIDAL, OSCILLATING, WAVE AND INTERRUPTED MODE GENERATOR

This apparatus shown on page 138 and found on the large specialists plate on page 137 is for use with either the direct or alternating street mode, and gives a great variety of modes and combinations. Heretofore the sinusoidal could only be obtained from the street alternating mode, or from a combination motor generator, or magneto machine.

Moving the lever at the top, from left to right varies the frequency and periodicity of the various modes, while moving the lever at the bottom from left to right selects the four modes and combinations, as follows:

"A" is the sinusoidal in cycles.
"B" is the oscillating, in strokes.
"C" is the wave, in undulations.
"D" is the interrupted in breaks and makes.

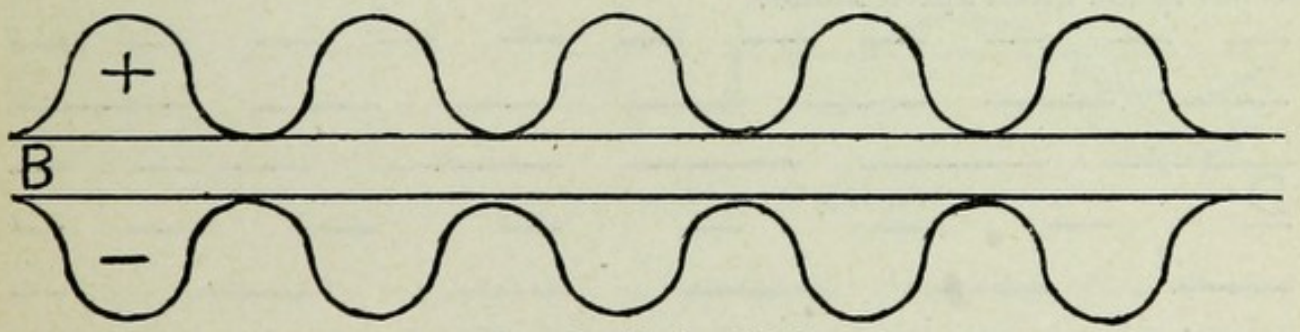
What is the sinusoidal?



The Sinusoidal Mode.

The diagram "A" shows the curve which represents the sinusoidal mode. In this drawing and the ones following, the horizontal line represents the neutral or zero line between positive and negative. In the curve "A" there is a rise of potential, followed by a fall, which goes from the positive to the negative, as shown by the curves above and below the line, and marked (+) and (—). This makes one complete cycle.

What is the oscillating mode?



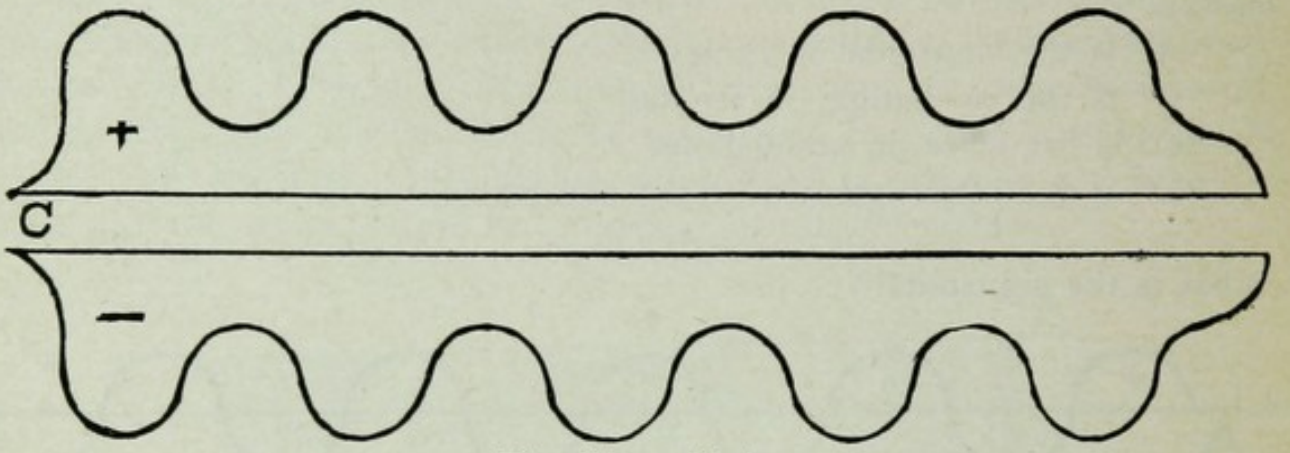
The Oscillating Mode.

The diagram "B' shows the curve which represents the oscillating mode. In this drawing the curve shows a rise and fall of potential, above

the line, which goes down to zero, but not below it, which is immediately followed by a similar rise and fall, as shown by the curve marked (+).

This same thing is shown in the lower drawing, as below the line, where there is a fall of potential, which is followed by a rise to the zero line but not above it, which is repeated, and shown by the curve marked (—). The potential in the oscillation mode varies, but the polarity does not change. The oscillations may be either positive (+) or negative (—).

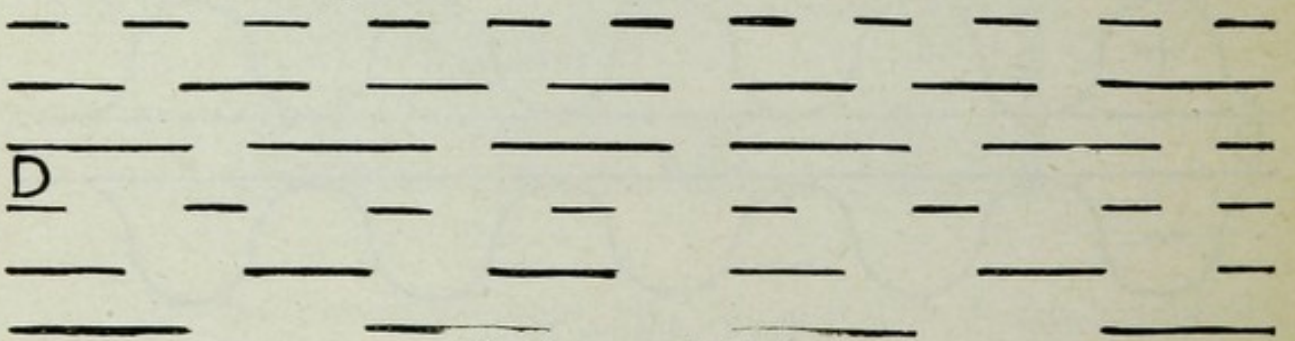
What is the wave mode?



The Wave Mode.

The diagram "C" shows the curve which represents the wave mode. In this drawing the curve shows a rise of potential followed by a slight fall, but not to the zero point of beginning, and is followed by another rise and fall, but never to the zero. This is a sustained fluctuating mode. This mode may be obtained on the negative side or below the line of zero, as shown in the lower drawing. In the wave mode the polarity is more marked, and may be likened to waves on the ocean at either high or low tide.

What is the interrupted mode?

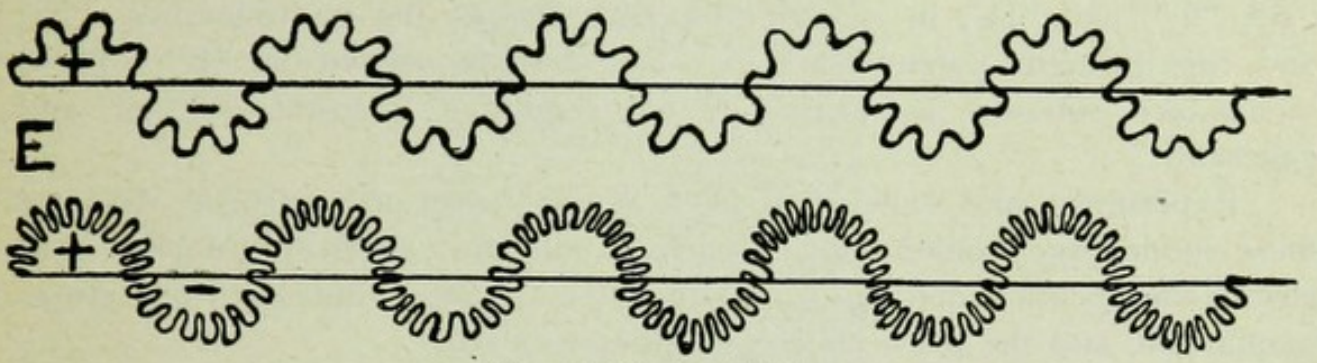


The Interrupted Mode.

The diagram "D" shows the lines of potential, which may partake of either positive (+), or negative (—) polarity. The make and break may

vary in frequency, as shown by the different lengths of the lines and the spaces between them. The lines representing the time during which the mode acts, and the space, when it is inactive. In this mode the potential is constant, when once the mode is operating through the circuit.

What is the multiplex mode?

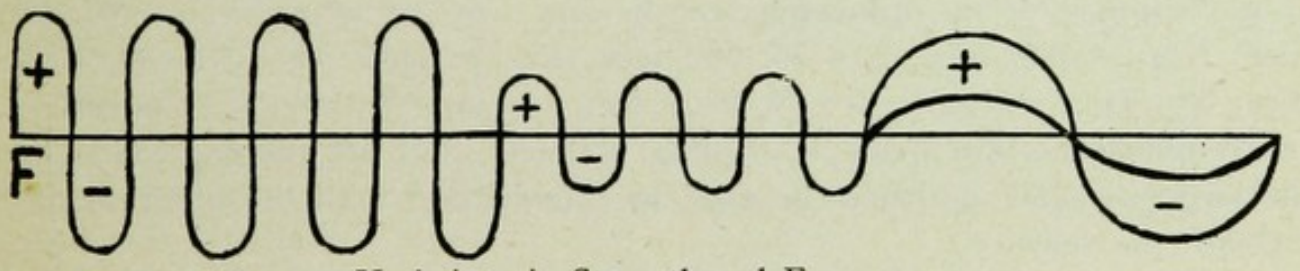


The Multiplex Mode.

The diagram "E" shows the curves, which represent the multiplex mode, as used in combination with the sinusoidal. These drawings indicate that while the sinusoidal mode is operating, there is a secondary effect made apparent at the same time, which may be likened to small ripples often seen on the surface of waves of water when the wind blows, and which robs the billow of the smooth glassy surface.

The upper drawing of diagram "E" shows one frequency of the multiplex mode, and the lower drawing a still more rapid one.

While "E" shows only the multiplex sinusoidal, it may be had in combination with any of the other modes, shown in "B", oscillating, "C", wave, or "D", interrupted. For economy of space only one multiplex combination is drawn.



Variations in Strength and Frequency.

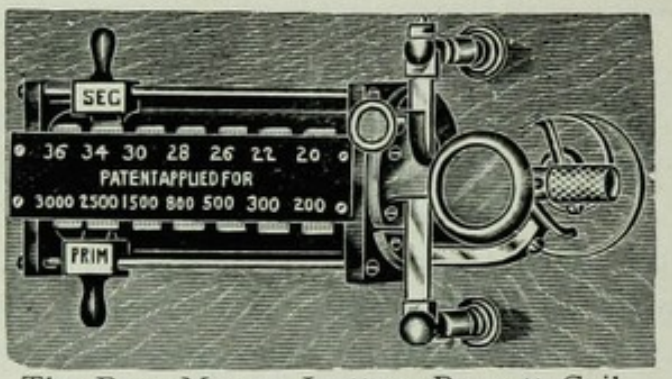
The diagram "F" shows the curves of the sinusoidal mode divided into various potentials, cycles and periods. This drawing can be applied to either the sinusoidal, "A", oscillating, "B", or wave "C", modes.

The curves at the left, show a high positive (+) and negative (—) potential, through four cycles. The middle part shows a lower potential,

both positive (+), and negative (—), through three cycles, but both parts show the same periodicity.

The curves at the right show both a high and a low potential, positive (+), and negative (—), through one cycle, and with a longer period. The combination generator in the specialists cabinet will enable the operator to make use of all the modes shown in the diagrams "A", "B", "C", and "D", in combination with any of the multiplexities, "E", and the different potentials, cycles and periods, shown in "F". These modes are obtained by means of the regulator, rheostat, selecter and generator.

Experiment and experience have demonstrated the intrinsic value of these modes and combinations, in electro-physics, electro-physiology, and electro-therapeutics, and this apparatus is a valuable addition to our armamentarium, and the price makes it within reach.



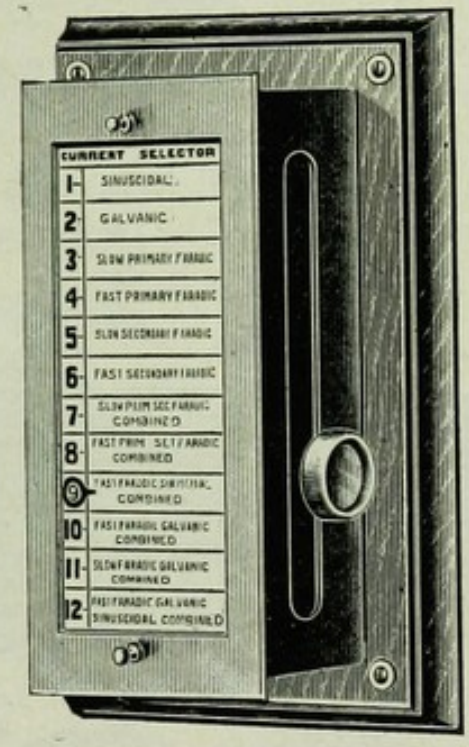
The Pope-Massey-Juettner-Bennett Coil.

This coil is a great improvement over the usual faradic or induction coil. It is made in seven sections, any or all of which may be used in a great variety of combinations. Both primary and secondary modes may be used at any rate of interruptions, with the fast and slow vibrators. It is composed of the following lengths and sizes of wires: No. 20, 200 feet; No. 22, 300 feet; No. 26, 500 feet; No. 28, 800 feet; No. 30, 1500 feet; No. 34, 2500 feet; No. 36, 3000 feet. Total 8800 feet. The different combinations are made by sliding contacts, and all are controlled by the large rheostat, and may be used in combination with the other modes through the selecter.

THE MODE SELECTOR

This apparatus is of great assistance to the operator, for the selection, and combination of the various modes derived from the galvanic, faradic and sinusoidal generators. It does away with switches, makes the selection and combination positive, and correct; no guess work. It resembles a telephone board, in that you simply select your mode, instead of

plugging in for your subscriber. The knob at the right turns, and the indicator travels up and down a scale with a rack and pinion gear, that is so simple, as to be a wonder that we did not have it before. The following is the list of fifteen selections, to be made, any or all of which may be multiplied by varying the modes from the several generators con-



The Mode Selector.

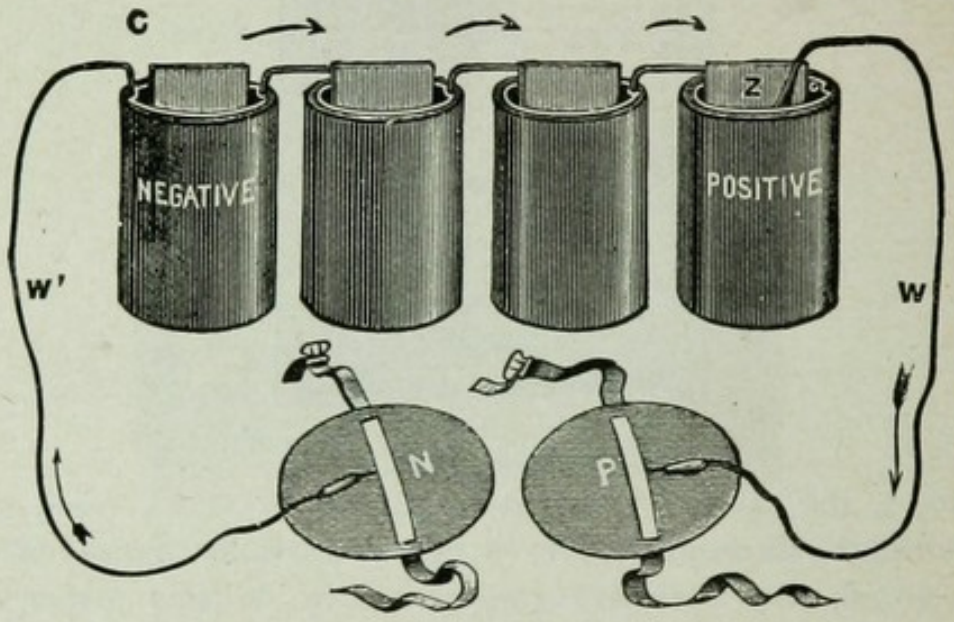
nected. No. 1, the cautery, when it is attached. No. 2, rapid sinusoidal. No. 3, multiplex sinusoidal. No. 4, slow galvanic sinusoidal. No. 5, galvanic. No. 6, slow primary faradic. No. 7, fast primary faradic. No. 8, slow secondary faradic. No. 9, fast secondary faradic. No. 10, slow primary and secondary faradic combined. No. 11, fast primary and secondary faradic combined. No. 12, fast faradic and sinusoidal combined. No. 13, fast faradic and sinusoidal and galvanic combined. No. 14, slow faradic and galvanic combined. No. 15, fast faradic and galvanic combined. These are made in two sizes, one with twelve selections for the wall cabinet, and the one described above with fifteen selections for the large floor cabinet.

What is an electric belt, and its uses?

The ordinary so-called electric belt is a fake pure and simple, made to sell, and then to disintegrate. This is for two reasons, one to make room for another sale, and the other is to destroy the evidence of the first fraud. They are usually a flexible chain of pieces of zinc and copper, covered with felt or some other absorbent material, which is soaked in some dilute acid,

usually acetic. This comes in contact with the two metals and creates a slight mode. The cheap, impure materials used soon cause local chemical decomposition where the metals hinge, corroding them, so that they soon fall apart, and that is the end of that man's cure, money and "vinegar belt," as well as his patience. He knows not the difference between the genuine and the counterfeit and says batteries and electrification are "no good," and brands all, whether "fakes" or scientific electro-therapeutists, as dishonest.

There is nothing to prevent a galvanic battery being made in the form of a belt and worn around the body, but in order to do so it must be made of very small cells, which we know will have very small strength, and a corresponding diminution of results. The accompanying cut shows the proper construction of a galvanic cell belt.



If you must use a battery in the form of a belt, and in my twenty-five years of active experience I have yet to see the first case of absolute necessity for one, then get one made of real cells, built on scientific principles, and not a toy. You cannot afford to risk your reputation experimenting with any apparatus with such a "shady past," having no real "present," and such a faint and far off promise of a future. It is safe to say that the result offered by the use of a belt is only a delusion and a snare.

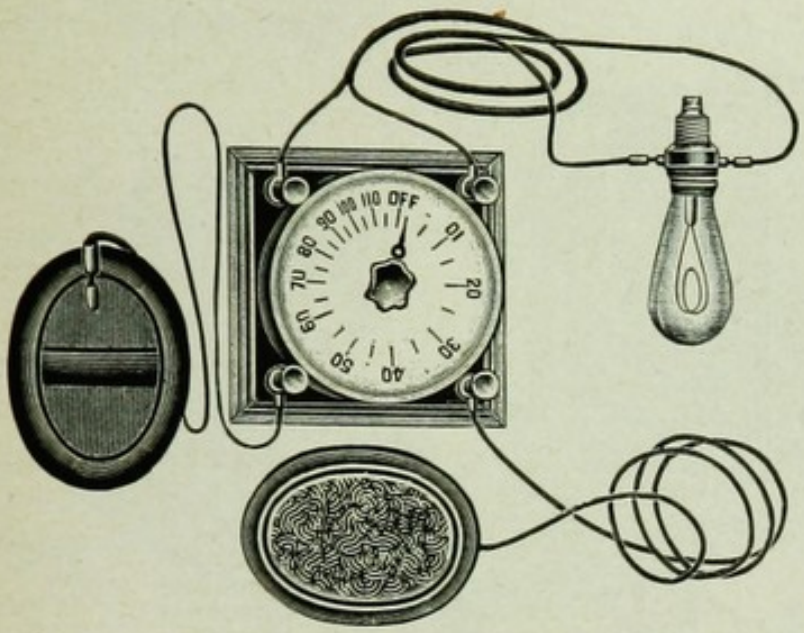
SINUSOIDAL AND GALVANIC PLATE

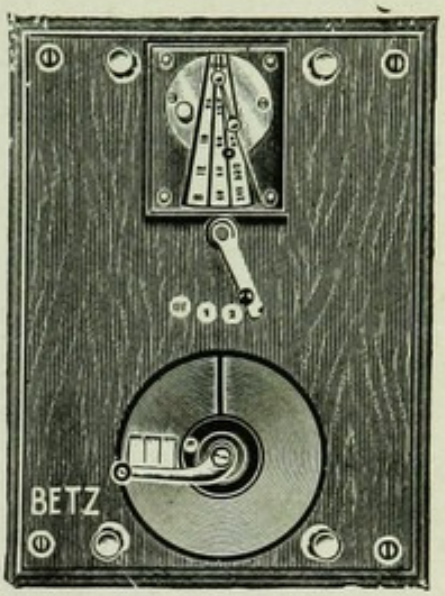
How may we utilize the street modes in a simple manner?

The apparatuses on page 145 are simple and convenient and inexpensive appliances for utilizing the direct and alternating street lighting modes for therapeutics. These are intended more especially for installation in wards and rooms of patients, in connection with baths, etc.

One consists of a small graphite rheostat, a rheotome, switches and posts, mounted on a wooden or marble plate attached to the wall, and connected to the street mains.

The other consists of a rheostat only. When the voltage is cut down





by means of a lamp in series, the strength is controlled by the rheostat lever. They are simply connected to the lamp socket of any fixture and the electrodes applied. The direct mode will give the galvanic, and the alternated mode will give the sinusoidal effects. Their best points are their simplicity and low cost.

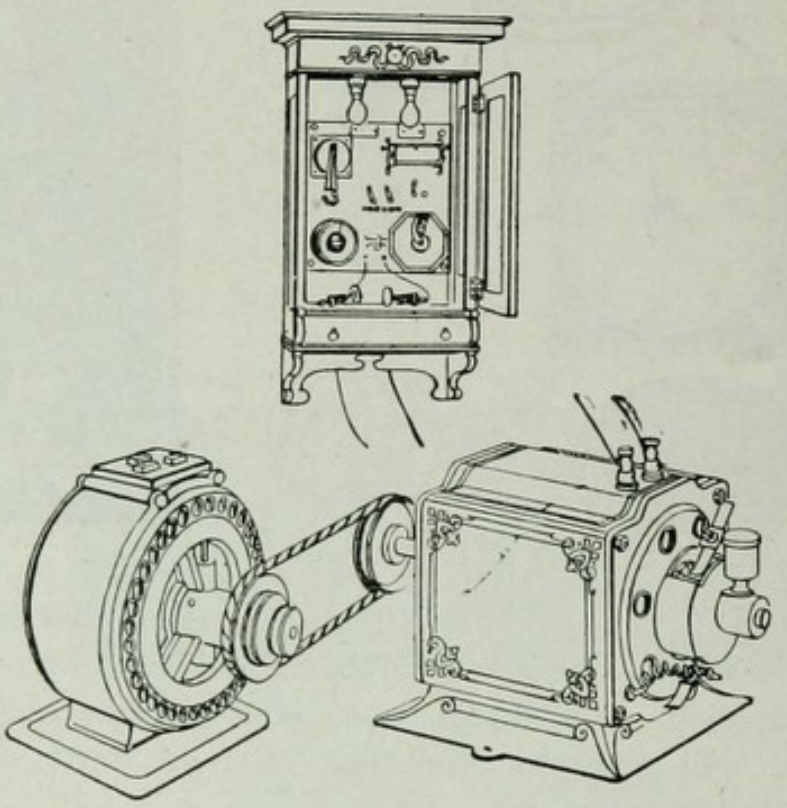
How may alternated commercial modes be utilized in electro-therapeutics?

Alternating commercial modes may be used to produce the sinusoidal mode, for cautery purposes, for diagnostic lamps, and by the use of a transformer it may be used to produce the effects of a direct mode. The transformer is a motor whose power is derived from the alternating mode, and is utilized in running a direct mode dynamo. This apparatus is called a motor-generator. A motor generator can be used to transform an alternating mode to a direct, but this is expensive. An alternating mode can be used for lighting and power, and can be transmitted long distances more cheaply than the direct mode.

What is a motor-generator, and its use?

Another method of utilizing the alternating mode in electro-therapy, although in a rather indirect manner, is by transforming it to a direct mode

which may be employed in producing galvanic effects; a motor-dynamo outfit, so styled, is used for this purpose. The process of transforming the mode really amounts to developing power by passing the alternating mode through a small alternating motor; the shaft of this motor is either geared or connected directly with the shaft of a small direct mode dynamo; the

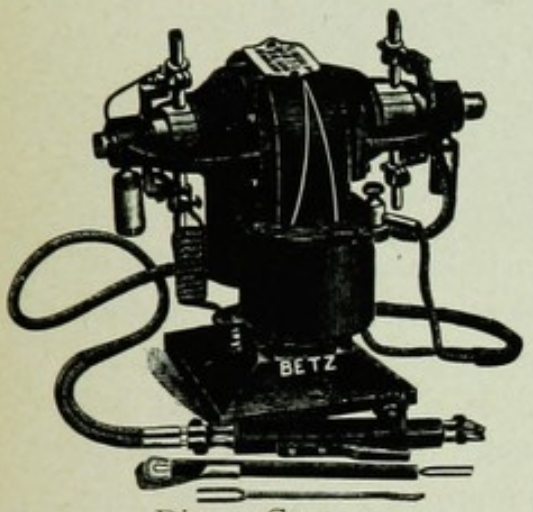


power thus produced operates the dynamo, which generates a direct mode of suitable voltage and amperage to be used in connection with a galvanic wall plate; this mode may also be employed to excite the action of the faradic coil of a physician's switchboard. Strictly speaking, the alternating mode employed in this method is used as a mechanical agent, rather than as a therapeutic force.

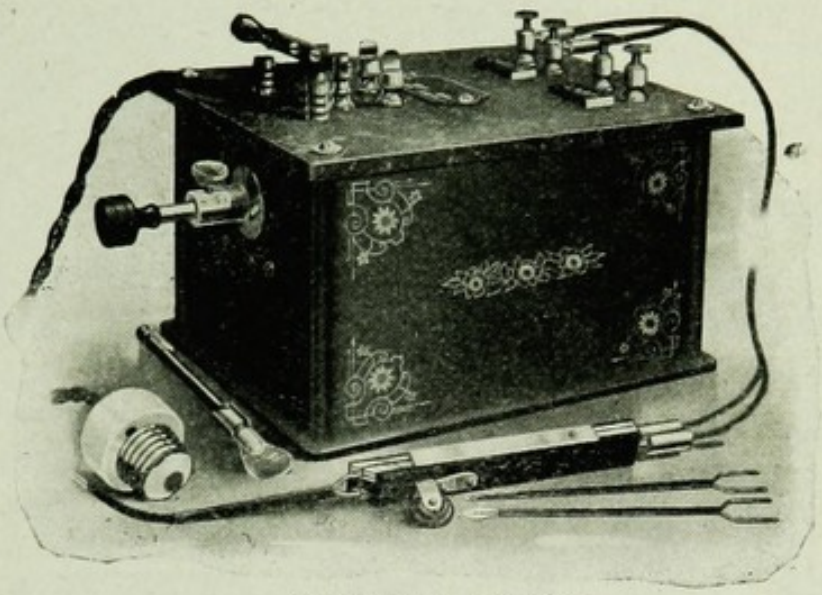
What is a cautery-transformer, and its use?

Another mode of employing the commercial modes, although a surgical rather than a therapeutic method, is in galvano-cautery. This is quite an important branch of electrification with the physician making a specialty of eye, ear, nose and throat work. The great advantage of cautery in many minor cutting operations is in the almost certain avoidance of hemorrhage. A transformer working on the principle of an induction coil is used to adapt the mode to cautery work. The 110 volt or 55 volt alternating or the 110 volt or the 220 volt direct mode is attached to the

proper binding posts of the transformer; a mode of about two amperes is thus fed to the appliance. The transformer converts this mode of 110 volts and two amperes to one of about six volts and thirty or forty amperes, which is sufficient to heat most platinum cautery knives and loops.



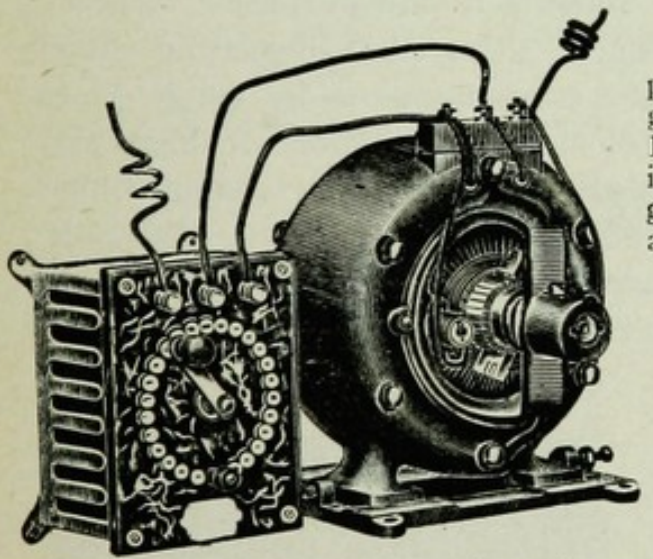
Direct Cautery.



Alternating Cautery.

The cautery transformer is a very simple device and makes a most valuable addition to the equipment of a physician who has the alternating mode available.

ELECTRIC MOTORS, BOTH DIRECT AND ALTERNATING

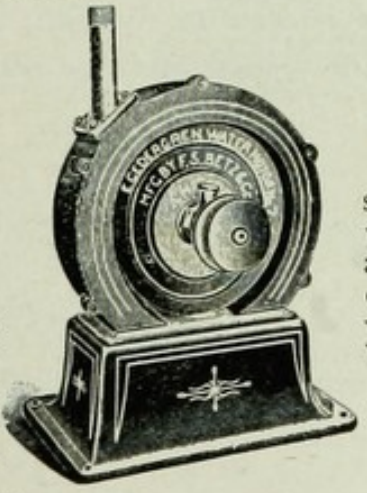


This alternating motor is the only one made that can be operated with a rheostat, any speed obtained by merely changing the lever of rheostat, the same as with any direct motor; no mechanical speed controller required.

Generator

If you have alternating power and use a motor or gasoline engine and want 110 volt direct for operating a galvanic battery this generator will give you ¾ ampere.





Water Motor

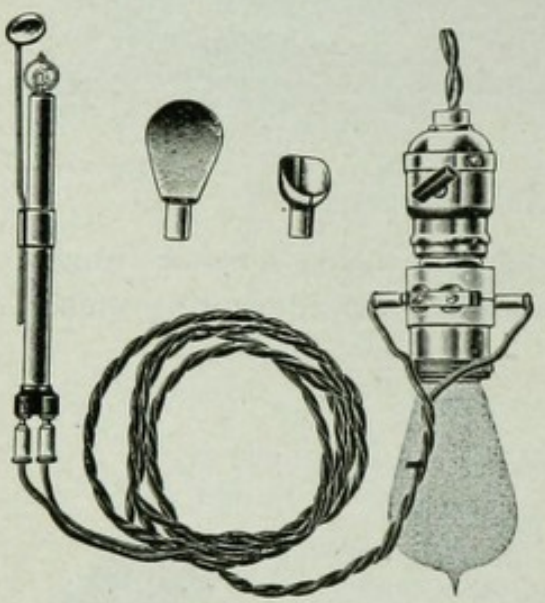
For running static machines, pumps, vibrators and generators for operating a galvanic and faradic battery.

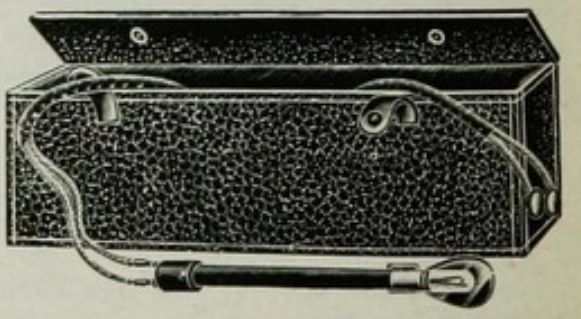
Put the large belt wheel on the rear end of main shaft at outside of case. A speed controller should always be furnished with a motor. Start motor slowly, never with a jerk. It is seldom necessary to run a machine faster than 350 revolutions per minute for X-ray work.

To oil the machine, fill the oil cups with vaseline or some hard oil. A little grease on the fiber collar will stop any squeaking of the shaft. After the oil cup is filled with vaseline give the top of cup a turn once or twice a month. This will force the grease into the bearings.

How is electrification used in diagnosis?

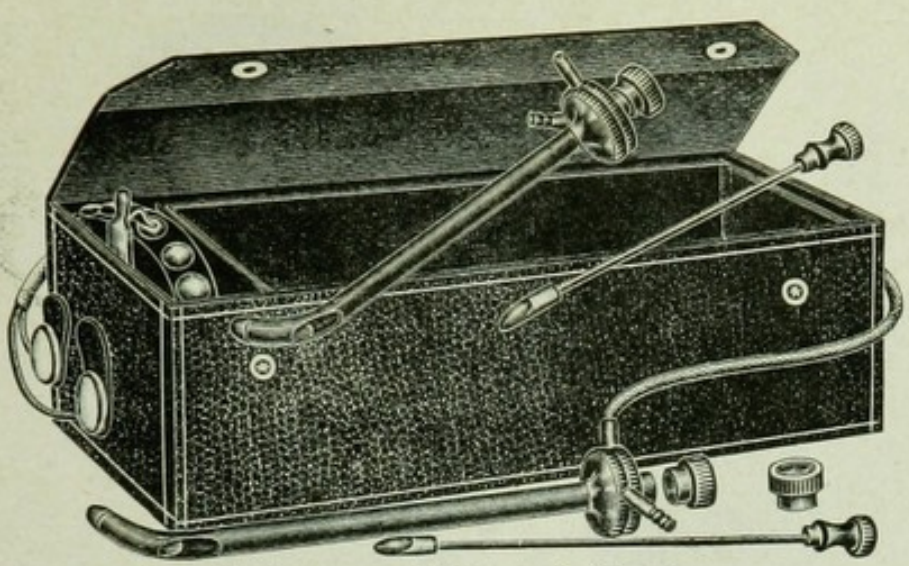
Another use to which the alternating mode may be subjected is to light diagnostic lamps. Perhaps this matter may seem a very simple one to dwell upon at first thought, but upon further consideration the complexity of the subject will be appreciated. There is frequent call for a wall plate or other piece of apparatus which will combine a mode for diagnostic lamps among other features; this is an easy matter to arrange, regardless of whether the plate is to be used with either direct or alternating mode; but especial stress should be laid upon the fact that a separate contrivance, such as a large, heavy graphite rheostat will prove more suitable to the purpose. Another manner of using the alternating mode to light small lamps is by using series lamps in connection to regulate the flow of mode. A number of diagnostic lamp sets are on the market which embody this principle, among which will be found a very unique one, in that the small lamp is absolutely guarded against an excess of current; which may be accidentally encountered when used with a wall plate or other controller.





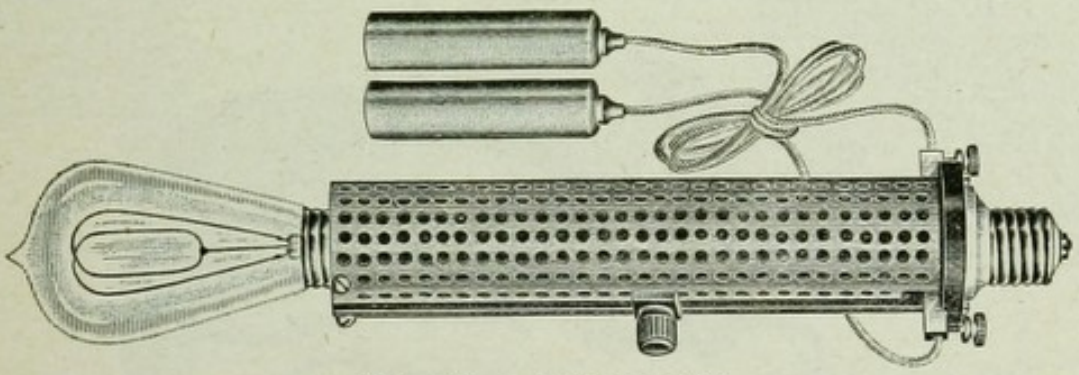
DIAGNOSTIC LAMP

In case with cells, lamp and tongue depressor which can be removed thus making a good outfit for throat, vaginal and rectal work.



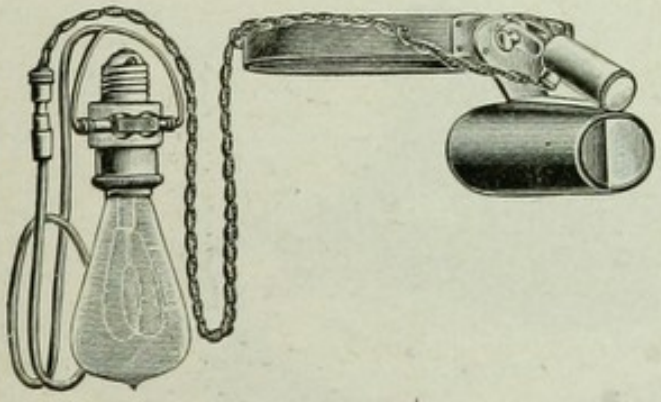
Cystoscopes, Male and Female.

Two separate instruments, 15 or 18 Am. scale with magnifying lens in case with cells and controller.



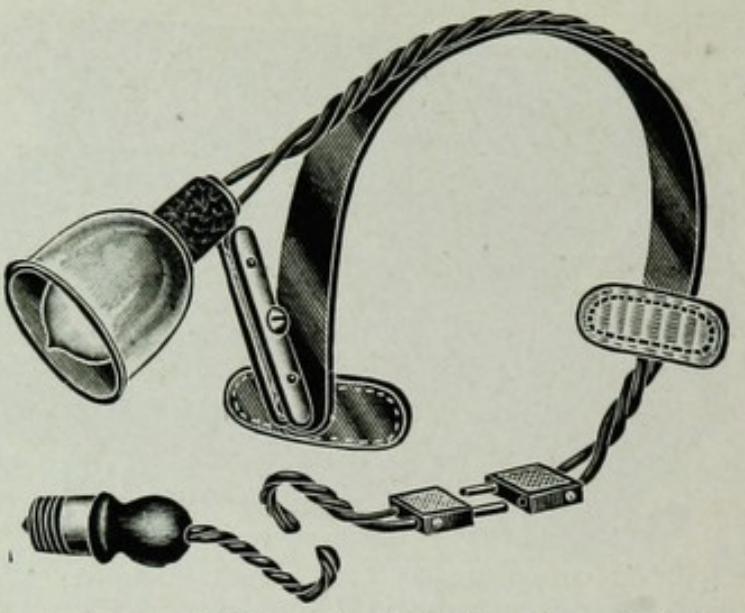
Galvanic and Sinusoidal.

Controller for operating cystoscope, head lamps, diagnostic lamps, retinoscope, ophthalmoscope, lamp for testing eyes, all complete to attach to any 110 volt lamp socket. When used with a direct mode, you get the galvanic effect. When used with the alternating mode you get the sinusoidal effect. It has a sliding contact over a rheostat for regulating the strength.

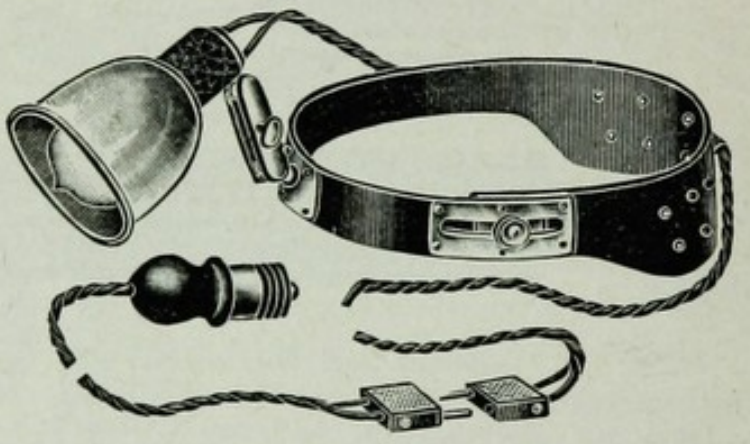


STEREOSCOPIC BINOCULAR HEAD LIGHT

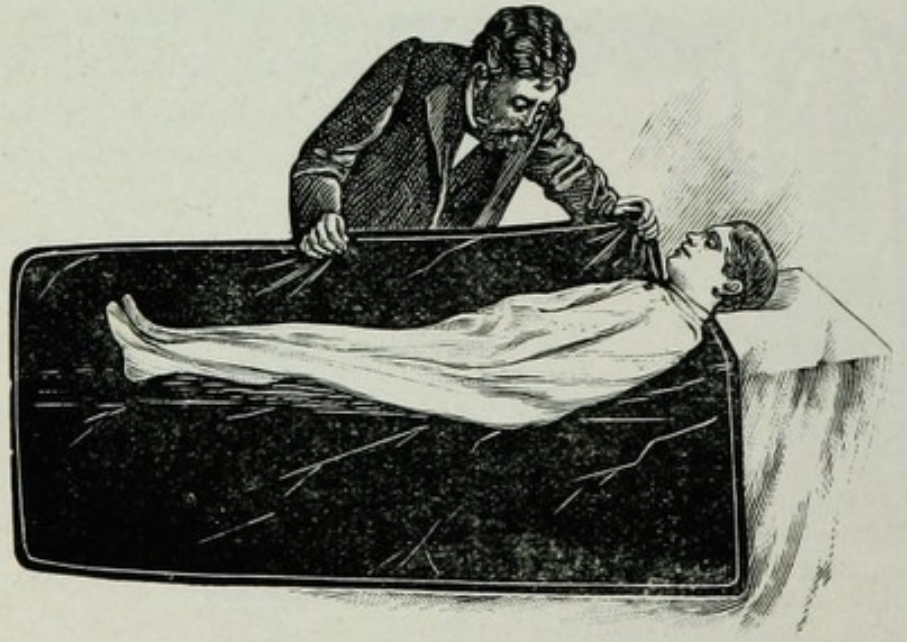
This shows an improved head light, with stereoscopic binocular magnifiers, which will be greatly appreciated by those requiring a means of brilliant illumination over a limited area and for close and careful work. It leaves both hands free, and may be quickly attached or detached by means of a handy connector.



Head Lamp. With cut out, ball and socket for 110 volt.

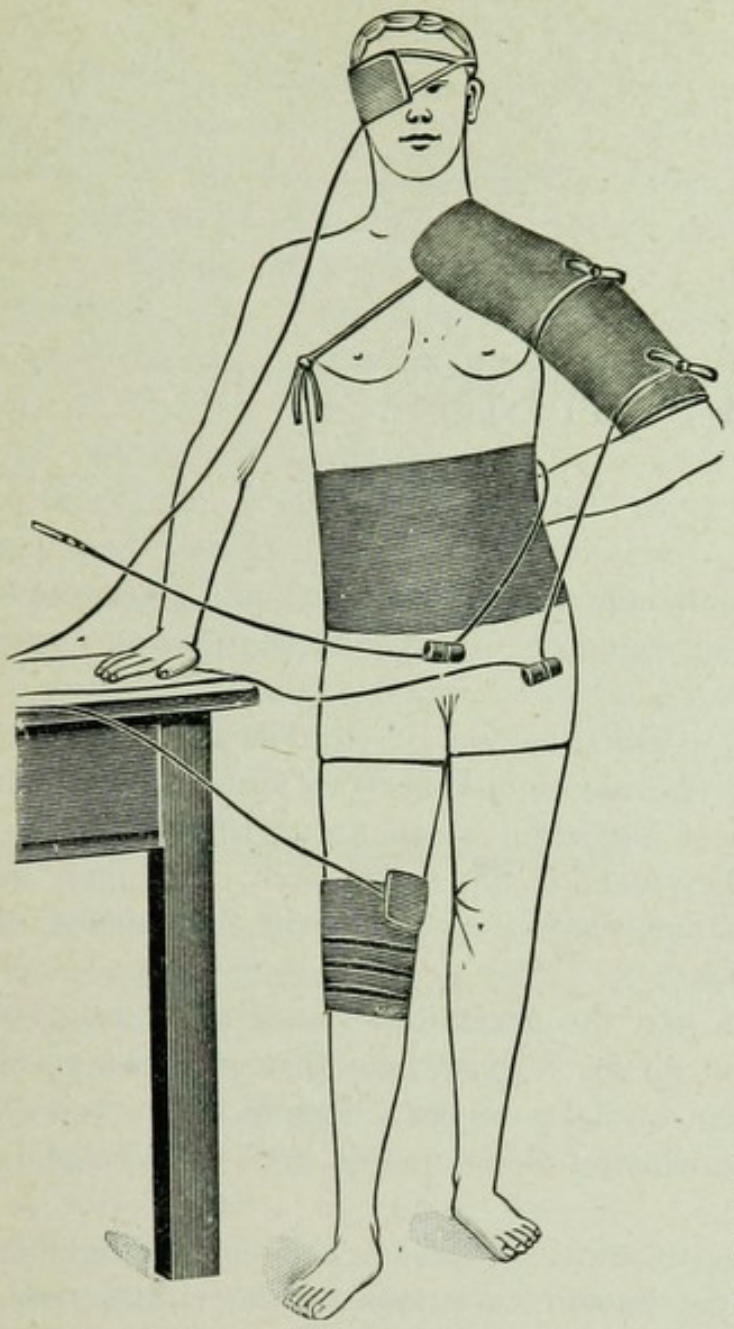


Head Lamp. New model with cut out for any 110 volt mode.



ELECTRIC BLANKET

Made large enough to envelope entire body except the head. When used dry produces the same effect as a Turkish bath. When used outside a wet pack will act like a Russian or vapor bath. Heat easily regulated and may be held at any desired degree of temperature, will not break, short circuit, or get out of order.



ELECTRIC BANDAGES

Made any length and width for the purpose of applying heat.



HEATING PAD

Made all sizes and styles for the treatment of pneumonia, rheumatism, neuralgia, painful or delayed menstruation or wherever hot applications are indicated.

The 12 x15 inch pad recommended for cases of pneumonia. Instead of using poultices, use flannel and put the pad on top. May be arranged for giving 3 different heats with cord and plug for lamp socket.

CATALYSIS

What is meant by catalysis?

By catalysis we understand the nutritional, chemical and physiological effects produced in tissues and organs of a body by the passage, over or through, of electric modes.

This catalytic action, is that peculiar action of electrification, or that effect which it has or exerts upon the vaso-motor nervous system, by which it affects nutrition, and is the most important of all the attributes of electrification, and catalysis is the keystone of the entire arch, and upon its thorough understanding depends our success or failure in the science of the practice of electro-therapeutics.

Therefore, let me urge upon you the great importance of thoroughly mastering this subject, and if you do so, I assure you that you will never be at loss to know what application to make, to get a desired effect, and all the therapeutics of electrification which follows in this book will be plain and easy.

Catalysis, is entirely a physiological process, dependent altogether upon the definite action of all the known variations of the electric condition, known by whatever name they may, galvanic, faradic, static, high-frequency, sinusoidal, cautery or X-ray phenomena.

We see at once from this fact, how universal and far reaching is this catalytic action, and how necessary it is to know and understand, because it follows in some way either beneficial or harmful, good or bad, upon every application of electrification, from every known source of generation, and from all methods of application.

By the catalytic action, the nutrition is directly and indirectly, locally and generally affected, and by this process the stimulation, sedation, temperature, growth and function of every part of the body can be more or less accurately regulated through the vaso-motor nerve supply to the part, thus controlling the circulation.

All positive applications will produce sedation, relieve pain and inflammation, contract blood vessels, thereby quickening circulation. All neg-

ative applications produce stimulation and dilate blood vesels, thereby slowing the circulation.

These are the direct local effects, while at the same time there are manifest indirect general effects in remote parts.

This accelerated flow of blood will, by osmosis, hasten the removal of waste products, and at the same time replace the loss with fresh deposits which feed the parts, making them grow. The increased blood supply also has a thermic effect, warming the cold parts and cooling the hot parts by re-establishing the normal equilibrium. This removes deposits, hypertrophies and effusions, and on the other hand nourishes and feeds atrophied and wasted and starved conditions.

You at once readily see that this nutritional effect of electrification is of the greatest importance. If we increase the nutrition of a weakened or diseased organ or tissue we assist in strengthening it and restoring it to its normal condition.

How does electrification effect nutrition?

Electrification effects nutrition by stimulating the circulation and hence bringing or sending more blood to the parts and providing more pabulum for the cells of the tissues. It also stimulates and assists the absorbents in their work and hastens the depuration of the tissues and organs, of effete products. The direct effect upon the trophic nerves and also the indirect nervous stimulation is also marked.

It is through the process of nutrition that the majority of chronic cases are cured. Improve the nutrition of an atrophied part and it grows larger. Improve the nutrition of a hypertrophied part and it grows smaller.

Electrification appears to effect its curative results first in acting as a general tonic to the entire organism. By stimulating the circulation, the whole vegetative system seems to put on renewed action. Glandular secretions are stimulated, absorption promoted, the waste of the system is carried off with greater rapidity, repair is hastened in still greater proportion. Nutrition is increased, the vital nerve force is endowed with greater strength, and the whole well being of the organism becomes improved to a wonderful extent.

How electrification acts, whether through its mechanical action upon all muscular tissues, or its physiological action upon all the organs and glands of the body, or its chemical action upon the contents of the minute cells of which the tissues are composed, or the blending of these combined effects, would require volumes tell it, but the fact remains that

electrification will build up a reduced system better and quicker than any other known means.

These effects are brought about in various ways, and the processes are mechanical, thermic, physical, chemical, physiological, secretory and absorbent.

What are the physiological effects of electrification?

The catalytic action is doubtless responsible for the results produced in the treatment of chronic exudations of the joints, glandular enlargements, cicatrices, swellings, fibrous adhesions, contusions, sprains, etc.

The process started by the action of the mode continues for some time after the treatment has ceased.

Through proper electrical treatment we may increase or diminish or modify the action of an organ or tissue.

We may affect the circulation and the absorbents and promote secretion or excretion. This is through a physiological process.

In the same manner we may, with the proper mode and the proper method of application, produce various phenomena upon the skin, increase the process of exudation, raise the temperature, affect the nerves of special sense, causing flashes before the eyes, a peculiar taste and odor, and by electrizing the pneumogastric nerve increase or diminish the heart's action.

Through the effect of electrification upon the heart and upon the muscular fibres of the arteries we may affect the circulation most decidedly. We may also influence the circulation through the central and peripheral nervous system.

Through a general treatment of electrificaion, either mode being used, we may affect capillary circulation, increase the flow of blood, dilating the veins and producing an elevation of temperature.

Through the increase in circulation the warmth of the parts is increased and will usually remain at an elevated temperature for some time after the treatment.

What are the secretory effects?

A mode of sufficient strength will stimulate the activity of the secreting organs.

The SECRETION of the mucous membranes, the salivary glands, the stomach, liver, kidneys, etc., may be very greatly increased by proper electrical treatments. All are capable of stimulating the secretions of all these organs, but the galvanic mode acts more powerfully and produces better results. Many cases of catarrh may be cured by stimulating the secretions of the mucous membranes.

We may also stimulate the menstrual flow, the secretion of milk, the flow of saliva, the spermatic fluid, the action of the sweat glands, etc. Under the proper heading will be given directions for the proper application of the mode in producing these conditions.

It should be understood that the benefits derived through the use of electrification in influencing nutrition is due partly to the indirect as well as the direct action of the treatment.

What are the absorbent effects?

The ABSORBENTS may be stimulated through the use of the galvanic mode and through the stimulation of circulation and also through the chemical effect, influencing the process of osmosis, we may reduce hypertrophies, morbid growths, effusions, etc.

Electrification properly applied is the most valuable treatment known in removing thickening of the skin, enlarged joints and glands, and in many kinds of tumors.

There is scarcely a chronic disease treated with electrification where we cannot trace at least a part of the good results of treatment to the results of nutrition. In treatment of almost any chronic disease always remember that electrification properly applied will stimulate the circulation, and that the increased flow of blood will bring an increased amount of nutrition; that the contractions of muscular tissue produce the same effect as massage or gentle exercise; that nutrition may be affected through a chemical process; that the process of waste and repair may be promoted, and that the nutrition of the entire system may be improved through the indirect action as well as by the direct effect of treatment, securing a constitutional, tonic, stimulating effect.

What are the mechanical effects?

The MECHANICAL EFFECTS of electrification as pertaining to nutrition can be explained in quite a similar way to massage. The faradic mode produces better mechanical effects than the galvanic mode.

The interrupted mode being constantly opened and closed, during its passage through the body produces very much the same effect as gentle tapping or pounding or rubbing of the parts. This communicates an effect to even the more deeply seated tissues.

The corpuscles of the tissues through which the mode passes are agitated and the beneficial results obtained are due in a certain degree to the endosmotic action which has been stimulated by the mode.

The static potential variation, which will be fully explained later, is very marked in this respect, as is also static vibration.

Phoresis, which will also be taken up fully later on in our study, is purely a mechanical process, and is brought about by the galvanic and the static modes and also by the X-rays, but it remains yet to be shown that it is any way secured with faradism, or high-frequencies.

What are the thermic effects?

THERMIC EFFECTS.—The passage of the mode through the tissues also creates heat. This is more noticeable in using the galvanic mode, but it has been demonstrated that even mild faradic modes temporarily raise the temperature of the parts through which they pass.

A static insulation almost invariably raises the body temperature and produces a restful feeling. The static insulation increases blood pressure, while the d'arsonval high-frequency auto-condensation mode will reduce blood pressure.

What are the physical effects?

PHYSICAL EFFECTS.—One of the physical effects of the passage of an electrical mode through the body is to cause transference of substances from one pole to another. The stimulation of this osmotic action depends upon the physiological rather than the mechanical or chemical effect of the mode.

What are the chemical effects?

THE CHEMICAL EFFECTS of electrification are secured by the galvanic mode, there being very little, if any chemical effect from the use of the faradic, or sinusoidal, and none at all from the static mode.

The chemical effects of electrification are chiefly of an electrolytic nature. Many of the chemical substances of which the human body is composed may be decomposed by the action of the mode. The effects produced by what is known as catalytic action of electrical modes are by an increased absorption produced by dilation of the capillary blood vessels and lymphatics, an increased capability of the tissues for imbibing fluid through osmotic processes, changes in the nutrition of nerves resulting from the stimulating and refreshing effects produced, changes produced in the molecular arrangement of tissues caused by electrolytic action and the result of the transportation of fluids from one pole to another.

Electrolysis, which will be explained in another place, is a chemical process, and is brought about only by the constant galvanic mode.

SEDATION AND STIMULATION

How do you cause sedation and stimulation?

The positive pole has a soothing sedative, anodyne effect on irritated nerves, relieving pain. The negative pole has a stimulating or irritating effect upon irritated nerves, and will increase pain. In inflammatory and congested conditions there is usually pain. Here the positive pole has a double action, both upon the vaso-motor and sensory nerves. Where there is pain without inflammation, it exerts its influence upon the sensory nerves only.

NO CONTRADICTION

Is electro-therapy contradictory?

Some who are not acquainted with these various polar effects, have condemned electro-therapeutics as being contradictory and paradoxical. They say that electrification is used to produce or relieve pain; to cause or reduce congestion; to enlarge atrophy and decrease hypertrophy. Therefore it is contradictory. But we, knowing the different and diametrically opposite polar effects, can explain the *seeming paradox,* and by following the known laws of electrification can get uniform results, and just as we want them. He who is ignorant of the fine points, has one chance out of two of getting the application right or wrong. We, who are instructed, take no chance and get the application right every time.

PHORESIS

What is meant by phoresis?

Phoresis is the generic term for that property that is had by the constant mode to drive compound substances—a compound salt in solution for example—into and through the tissues of the body. Also of moving substances in solution from one part of the body to another.

By phoresis is meant that power possessed by a galvanic mode to convey medicinal substances in solution and in contact with anode or cathode, through and into the tissues of the body with the view of securing the local effect of such remedies. The term need not be, nor should it be, confined to the introduction of substances without the body into it by this method, but may include the transfer of substances already in the tissues, whether normal to their composition, or not, from one part or place in the body to another; or from within the body or any part of it to the surface, with the view of removing such substances from the body. The primary physical phenomena illustrated by phoric action are those long since observed when the ordinary processes of osmosis were found to be modified by the passage of a direct or galvanic mode through the solutions and members in which osmosis was taking place. It was found that processes of osmosis could be hastened or retarded by the passage of such a mode according as the mode was made to flow in one or other direction. Though the fluids in tissues are themselves repelled from the anode and increased at the cathode, this is not true for all substances that may at any time be dissolved or suspended in those fluids, since certain elements and compounds are known to travel in the opposite direction from that which is usually assumed to be the direction of the electric mode, that is from anode to cathode.

In the light of the present knowledge, as the result of observation and experiment, the phenomena which we include under the name phoresis or electric-osmosis, must be regarded as the result of several causes operating at the same time and more or less inter-dependent, since certain of thse phenomena are electrolytic, some are mechanical, while others should be classified as chemical.

What is meant by anaphoresis?

Anaphoresis is the driving of substances in solution that are electro-negative, by the positive pole to or toward the cathode.

What is meant by cataphoresis?

Cataphoresis is the process of driving substances in solution that are electro-positive, by the negative pole to or toward the anode.

MODE DIRECTION

Of what importance is mode direction?

Much has been said and written concerning the different effects of the ascending and descending modes, but it is now conceded by the best authorities that what was supposed to be a difference in the effect of mode direction is due to the difference in action of the two poles.

We pay particular attention to the location of the two poles in the application of electrification and recognize the difference in action and effect of the positive and negative pole, but we do not recognize any particular difference in the direction in which the mode flows.

It is stated by some authorities that the descending mode, or the one flowing from the center to periphery, is more sedative in its effect, while the ascending mode, or the mode flowing from periphery to center, is more stimulating. We know that this difference in effect is produced by the two poles and have no reason for thinking that the direction of mode of itself has anything to do with the different effects produced.

VASO-MOTOR EFFECTS

What vaso-motor effect has electrification?

Electrification in its various modalities has different effects upon nutrition through the vaso-motor nervous system, affecting circulation. This is due to the polar actions of the mode. This effect was noted long ago, before we knew the polar actions of modes, and it was then thought that these effects were due to the mode direction, and much stress was laid on *ascending* and *descending* modes. That is, from the periphery toward the centers. Now, we know that these effects are not due to direction at all, but entirely dependent on polarity.

The positive pole will act on the vaso-motor nerves, supplying the muscular coats of the blood vessel walls, causing the circular fibers to con-

tract, and the longitudinal fibers to relax, thus lessening the caliber of the capillaries, and consequently lessening the amount of blood flowing through them. This produces anæmia. The negative pole has the opposite effect. It relaxes the circular fibers and contracts the longitudinal ones, thus enlarging the caliber of the capillaries and increasing the amount of blood flowing through them, inducing congestion and hyperæmia. The larger vessel not only carries more blood, but carries it slower. This favors the process of osmosis in both directions, and favors the nutrition of starved tissues, bringing them food and oxygen, and hastens the process of repair, and at the same time assists in the elimination of waste and dead matter.

Thus we see we can control the blood supply to a part, and cause or reduce both anæmia and hyperæmia, and feed atrophy, or rob hypetrophy by restoring the normal electric equilibrium or electro-tonus.

ELECTRO-TONUS

What is meant by electro-tonus?

When each ultimate particle of the body or part is in its own normal condition, and in its normal relation with its surroundings, it is in a state of normal electric equilibrium, and is in tune or tone. This state we call electric tone, or *electro-tonus.*

Electro-tonus is that condition of the nervous system and the body through it, in which there is an electrical equilibrium established, and the nerves and system of nerves act and react to physiological stimuli in a normal manner and to a normal degree. All electro-therapeutic treatments and applications are given with the end in view of establishing or restoring the normal electro-tonus.

What is meant by swelling application?

By swelling application is meant the process of beginning an electric treatment with a mild dose and gradually increasing to the highest point of tolerance without producing pain, and gradually decreasing it. This will produce more or less of a rhythmic contraction and relaxation of muscles, which is beneficial.

WHICH POLE TO USE?

This question is often asked and is important to know in using medicine by phoresis. Every element is an *ion,* with either a positive or negative electrification. It is one law of electrification that like poles repel

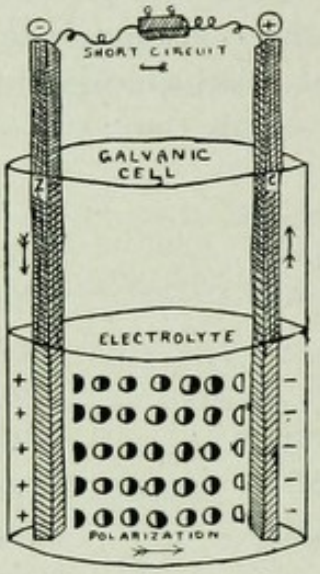
and unlikes attract, so that if corpuscles are free to move, there is a double action going on, of attraction and repulsion, and if we know the relative potential we can do good phoric work. Two elements may be of very unlike polarity like sulphur and chlorine, which are highly negative ions, and potassium, sodium and lithium, which are the highest positive ions; therefore, sulphate of morphine and hydrochlorate of cocaine having a negative attraction will be repelled by and driven into the tissues by the positive poles from which they are farthest removed *by repulsion.* Likewise iodide of potassium being attracted by the positive would be best applied under the negative which would most *repel* it, for in phoresis, although attraction and repulsion are both manifest, the *repulsion is the stronger.* A great deal of experiment has determined the relative position of the different elemental ions, and Berzelius's final series stands thus:

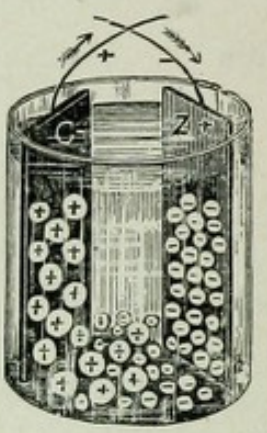
Electro-Negative			
Oxygen	Carbon	Copper	Zinconium
Sulphur	Antimony	Bismuth	Aluminum
Selenium	Tellurium	Tin	Didymium
Nitrogen	Tantalum	Lead	Lanthanum
Fluorine	Titanum	Cadmium	Yttrium
Chlorine	Silicon	Cobalt	Glucinum
Bromine	Hydrogen	Nickel	Magnesium
Iodine	Gold	Iron	Calcium
Phosphorus	Osmium	Zinc	Strontium
Arsenic	Indium	Manganese	Barium
Chromium	Platinum	Uranium	Lithium
Vanadium	Rhodium	Radium	Sodium
Molybdenum	Palladium	Polonium	Potassium
Tungsten	Mercury	Cerium	Electro-Positive
Boron	Silver	Thorium	

At first glance the above statements and table would appear contradictory, but remember the Berzelius table is based on the attraction of the ions, and not the *repulsion on which we depend most* for phoric effect, so that potassium being the highest negative ion is the most attracted to the positive pole, therefore gets closest to it and vice versa with oxygen and the negative. Change the poles and the ions would, if possible, all reverse their position on the list, metallic mercury, being near the center, would not care much which way it went, but the oxychloride of mercury. negatively attracted would be repelled most under the positive electrode. Two ions may be on the same side of the neutral point, and partake of and be attracted by the same polarity, but would be mutually repellant, and

the weaker would be pushed back, just as two strong men will contend for the same prize but the stronger will overcome the weaker and keep him away from first place.

When a difference of potential is established by a direct mode of electrification sent through a collection of molecules, each atom or corpuscle of any substance that is free to move, deports itself according as the electric charge it receives is positive or negative. Those atoms of corpuscles with a negative charge will move toward the anode, and those with a positive





charge, toward the cathode. The direction therefore, which a medicine in solution will travel, whether from anode or cathode, or the reverse, when the attempt is made to use it phorically, will depend on its initial charge.

Solutions of cocaine, and adrenalin hydrochlorate, aconitine or tincture of aconite, helleborine, mercuric bichloride, mercuric succinide, strychnine nitrate, menthol, thymol, hammemelis, thiosinamin, fibrolysin, verbascum, thuja, sulphur, ichthyol and eosine, can when used in contact with the anode, be conveyed into the tissues by anaphoresis; while calcium, lithium, sodium and potassium iodide, chloride and bromide, find entrance by way of the cathode. Just reverse the table of Berzelius, when thinking of phoresis, and you will see it.

Affinity is attraction, and the Berzelius table is based on attraction.

Phoric medication is just the opposite and is based on repulsion. Human nature and chemistry follow the same laws. You hate harder than you love.

The negative polar action and reaction is alkaline.

Likes repel and unlikes attract.

Oxygen is an acid, and has a strong affinity or attraction for its

opposite, hence gets closest to the alkaline negative pole, and farthest away from its like, the positive pole.

Oxygen is the highest positive element, and chlorine is five steps below. Therefore if you want to introduce any oxide or chloride or oxychloride into the tissues, you may do it in two ways, viz: Draw it in by the attractive negative pole, which loves lightly, or drive it in by the positive repulsive which hates vigorously. Copper is only slightly soluble, but when attacked by the hydrochloric acid of the tissues, liberated at the positive pole by electrolysis, it forms oxychlorides of the metal copper, which try at once to get out of disagreeable, and into more congenial company. The formation of the oxychloride of copper is purely chemical. Put copper into hydrochloric acid, anywhere and it will form. The electrification is not necessary.

The process of phoresis is complicated yet simple.

Ordinarily the human tissues are alkaline. The body contains oxygen of course, but in a fixed compound, viz: water.

Electrolysis breaks up this compound, water, and sets free the acid oxygen, which unites with the copper, rather than to return to its divorced hydrogen, because the copper is more of an opposite. Chlorine does just the same thing, and the hydrogen is left out, and flies away as a gas, being lighter. The copper oxychloride forms in the tissues. The copper metal is fast to the electrode, The new oxychloride is free to move, and it stands not on the order of its going, but goes at once, and it keeps on going as long as the repellant hateful electrification keeps nagging after it.

Electrolysis does not decompose copper at all. It decomposes water, liberates an acid, which forms a chemical compound, which is repelled by the positive pole. The same process goes on at the negative pole when we want to drive iodine into the tissues. Iodine alone will not penetrate the tissues. Try it and see. Iodine is also an acid, and will unite with the albumen in the tissues and stop. Iodide of potash however, is freely soluble in water, and will not coagulate albumen. Therefore we use the vehicle potassium to carry the iodine to the part we want to treat. Then it is seized by the pirates, (chlorides) and the iodine is robbed of the potash, and left alone to do its work. Potash is the closest to the positive by chemical attraction, being an alkali, and the positive an acid, and gets the farthest away from the negative alkaline pole, (its like) by repulsion.

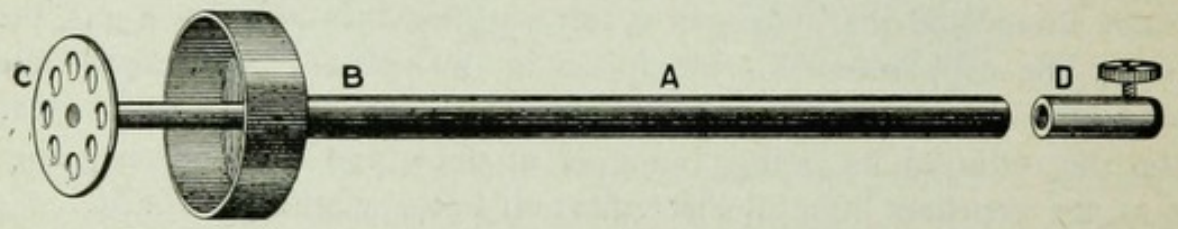
The drugs most used in electric phoresis are the alkaloids and halogen salts, the chief ones being cocaine and iodide of potassium. Cocaine hydrochlorate is a complex salt containing oxygen, nitrogen, chlorine, carbon and hydrogen, and by referring to the table, you will see that all of

these are electro-negative elements and are therefore best applied under the positive pole.

Iodide of potassium contains iodine and potassium, the iodine which we wish to use, being loosely carried in the vehicle, potassium, which is the element with the highest electro-positive attraction or affinity, is most *repelled* by the negative, and should therefore be applied phorically under the negative pole.

The potassium iodide being very soluble, easily carries the iodine into the tissues in a much less caustic form than iodine alone, and being higher in the scale than iodine, goes in faster and in greater quantity. Iodide of potassium is also a very unstable salt; having only one bond of union it is easily decomposed after it gets into the tissues, so that the iodine acts free within the tissues, and it is iodine we want in a rheumatic joint, and we can put in more in a local spot, by cataphoresis, than by the mouth, and do it more quickly, safely and pleasantly. Remember to apply cocaine and alkaloids under the positive pole (anaproresis), and iodide of potassium and other halogen salts under the negative pole (cataphoresis).

How may we save these costly drugs?



The Bennett Improved Slip Center Aluminum Disc Foric

The accompanying cut shows the improved Bennett slip center reservoir phoric electrode, which is the simplest and best of its kind. The stem (A) and cup (B), is of hard rubber. The disc (C) is aluminum. To use it, simply unscrew the binding post (D) on the stem, slip out the central rod attached to the perforated disc (C) for an inch, cover disc with absorbent cotton, tuck edges of cotton in behind the disc, and replace in cup, and screw on the binding post (D). Soak the cotton with the drug to be used and attach to the proper polarity, apply the wet surface to the part and turn on the mode. The cup should be level full of the wet cotton. When done using, lay aside, and allow to dry till needed again. Then simply wet with water or more of the drug solution, it is ready for use as before.

Ten drops of the tincture of aconite so applied gives relief from neuralgia for from eight to ten hours.

When used upon a constricted limb it is quicker and more effective in action, for the self-evident reason that there is no circulating blood to carry the medicament away. Goiters have been atrophied by the electric diffusion of iodide of potassium into their substance.

No special mode strength is required. There should be no pain, and not more than moderate discomfort. But it is a fact that the stronger the mode, the sooner the effect. It should also be remembered that the larger the electrode, the stronger must be the dose. Therefore the value of this small electrode.

Small operations upon a limb may be done under electrophoric anæsthesia, if aided by arrest of circulation. Thus, for instance, a section of the tendon on the back of the hand of pianists may be done in this way. The forearm is constricted so as to slow circulation. Cocaine and aconite may then be applied with the anode until the part is anæsthetized, when the section is at once begun.

Cocaine anæsthesia is more quickly produced, is more enduring in effects, and necessarily requires less of the drug, by this method, than by the usual injection without arrest of local circulation.

A four per cent. aqueous solution of hydrochlorate of cocaine placed in contact with a cutaneous surface by means of absorbent cotton or sponge will ordinarily have no effect in numbing the sensibility of the part, even if kept in place an hour or more. If, however, the same solution is used in the same way, but with the addition that a direct mode of 12 to 30 ma. is passed through it by means of the anode, the cuticle in the region of the anode is soon found to be in a state of cocaine anæsthesia and will remain so for a period varying from a few minutes to several hours, depending upon the strength and density of mode, the length of time it was applied, and the per cent. of cocaine in the solution used.

Every electro-therapeutist should have at least two of these, one for cocaine, and one for potassium iodide, both of which are costly drugs, but as there is no waste with Bennett phoric electrodes, they will save their price and value many times over.

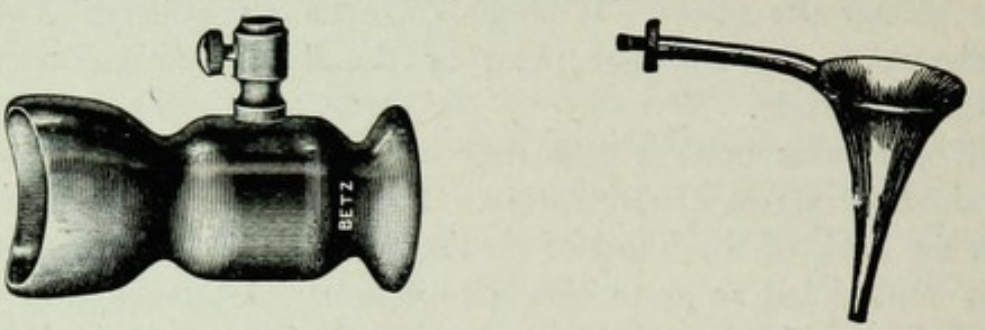
LOCAL ANÆSTHETIC

What is a good local anaesthetic?

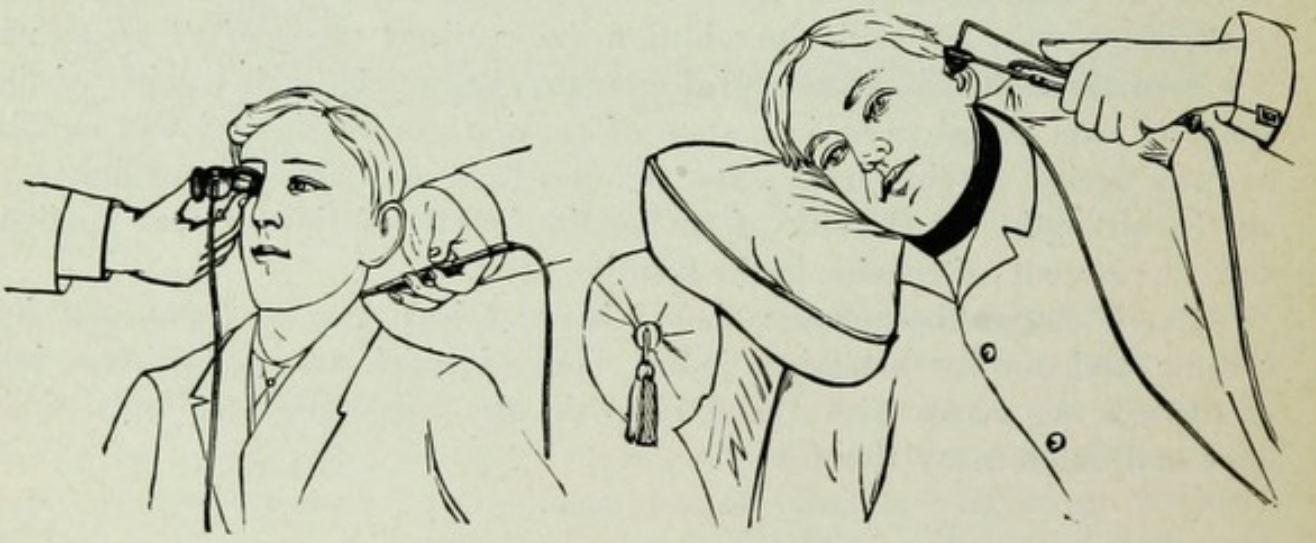
Adrenaline chloride, 2 drams; cocaine, 5 grains; water, half an ounce. Soak the cotton in the Bennett phoric electrode with the solution and apply as the positive electrode; place a negative electrode elsewhere and slowly induce a dose of 15 to 30 milliamperes, five to ten minutes. Then wash the surface with ether, when any small operation may be done without pain.

A one per cent. solution of stovaine, known as anæsthaine is also excellent. While it is slower in action, the effects are more lasting and the solution will keep indefinitely without deterioration, which is the great objection to cocaine.

SPECIAL HYDRO-ELECTRODES



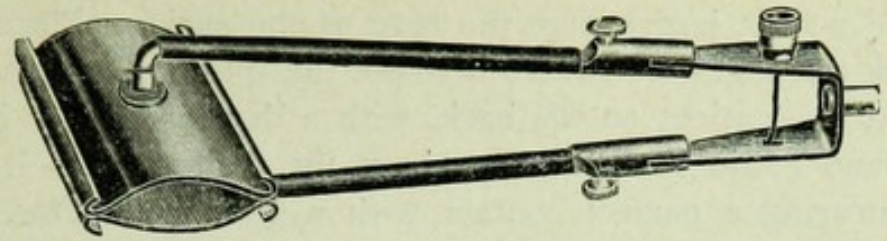
The cuts show two special phoric electrodes, for treatment of troubles of the eye and ear. These are to be filled with either plain or medicated water and applied to the eye or inserted into the ear, and then attached to whichever pole or mode is indicated. By means of these the most sensitive membranes and delicate tissues of the eye and ear may be safely treated. In these the water acts as the active electrode. The conducting cord is fastened to a binding post, which passes through the insulator and makes contact with the water.



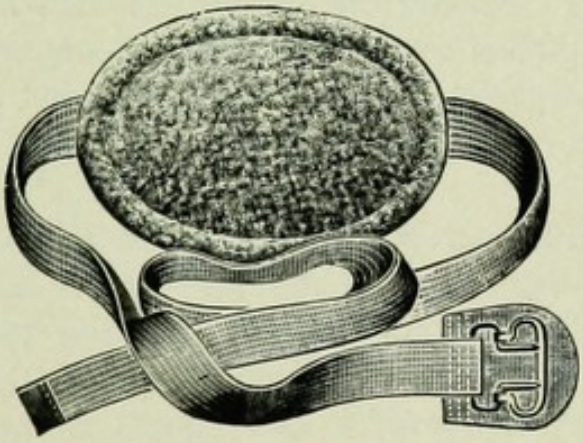
The sketches show the technique of the application of the special hydro-electric or phoric eye and ear electrodes. Fill the eye cup with water. Then lean over and apply it to the eye. Then holding it in position, straighten up with the eye cup as shown in the left-hand sketch above.

To use the ear cup, let the patient recline on his side. Introduce the funnel of the ear cup into the canal. Then fill with water and attach to battery as use as shown, in the right-hand sketch.

VARICOCELE PHORIC ELECTRODE

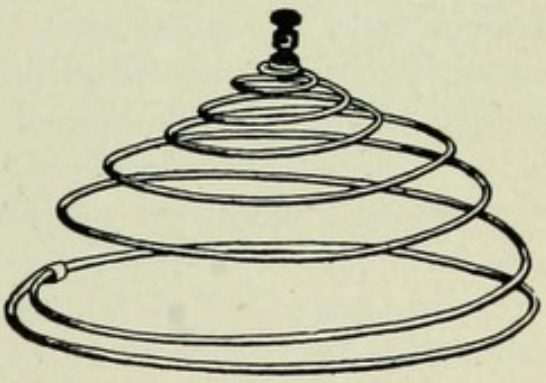


The above cut shows a special spring clamp electrode for the phoric treatment of varicocele. The drugs usually used with the varicocele phoric electrode are hemmemelis (witch hazel), thuja, iodide of potash solution, or adrenalin solution. The electrode is divided, with a block tin concave terminal on each side. Cotton saturated with the drugs is applied to the scrotum with the varicocele enclosed, then the clamp electrode is applied and tightened by the thumb-screw and connected to the battery, the other pole connected to the back electrode, held in place by a strap about the body, as shown below.



Flexible Rubber Back Electrode, 3 x 5 in. Can be buckled around any part of body.

THE BENNETT SPIRAL SPRING DISC ABDOMINAL ELECTRODE



The accompanying cut shows the abdominal electrode invented by Dr. H. C. Bennett, and is the simplest, and at the same time the most convenient and inexpensive electrode of the kind yet invented. It is light, cleanly, aseptic and strong. It is adapted to fit any surface or part of the body, and can be applied to the knee, hip, elbow, shoulder, head, back, or abdomen, but is intended mainly to fill a long felt want for a light, clean, strong and efficient abdominal electrode.

It is applied thus: Wring out of hot water a towel or pad of cotton, square or round, and a little larger than the base of the spring. Place the spring on it and tuck the edges or corners between the spirals, then place it on the abdomen, with the patient on the back, with a dry towel over it to protect the clothing and retain the heat, then have the patient press it down with her hands, insuring a perfect contact with a good conductor. We have given 200 milliamperes through this electrode without any discomfort. It is made of No. 14 spring steel wire, with a binding post at the apex, handsomely plated, and weighs only 4 ounces. Outside spiral is 7 inches in diameter.

ELECTROLYSIS

What is meant by electrolysis?

Electrolysis is the chemical decomposition of a compound body by electrification; anything that is subject to electrolysis is called an electrolyte, and as a compound body must contain water and a salt.

Nicholson and Carlisle discovered the process of electrolysis, and in the year of 1800 decomposed water into oxygen and hydrogen—so that the theory and process is not new. Electrolysis is the process of dissociation or analyzing a fluid, by an electric mode, hence the term electro-analysis or electrolysis.

The galvanic mode is the form that causes chemical decomposition, and the two poles have each a different potential, and for convenience the pole having the higher potential is called the positive, and the one with the lower potential is called the negative pole.

The direct or constant commercial or incandescent light mode has the same properties and characteristics of the chemically generated galvanic mode and will also produce electrolysis. However, owing to the usually high voltage of the street mode, and the sensitive nature of the parts where we usually desire to produce or cause electrolysis, it is generally advisable to use the galvanic mode for this work.

The galvanic form is a constant, steady, silent mode, and when applied mildly, will stimulate absorption and is useful in the removal of strictures, sub-involution, hyperplasias, exudates and foreign deposits, while with a powerful dose you can burn, cauterize or even destroy tissues.

Remember, this thermic or cautery effect is produced only by very strong doses, and is therefore not to be considered in electro-therapeutics, as an effect. Persons coming in contact with live wires, where a bare metal electrode or wire, a good conductor, is in contact with the skin, a poor conductor, the high potential mode concentrates its local polar effects at the point of contact and we have the same result we get in the cautery point, viz., a rapid production of heat and incandescence, and

cautery or thermic effects. But these effects of lethal doses are not what we mean when we speak of electro-therapeutic doses. Therefore, we say that electrolysis is not cautery or thermic, as some claim, but is a purely chemical effect on the tissues.

According to our understanding of the term, electrolysis refers essentially to the decomposition, re-arrangement, etc., of chemical compounds, induced by means of the electrical mode. This particular effect of electrification in its passage from one pole of an electrical generator, through any matter acting as a conductor back to the other pole, is a property belonging to the galvanic mode only, and is not produced by the faradic, magnetic, sinusoidal, static or high-frequency modes.

Again, this action of the galvanic mode upon the various compounds is due to the polar effect of such mode, which must be unbroken or uninterrupted for a certain considerable length of time, in order that there may be demonstrated any decided change going on in the electrolyte.

This action of the galvanic mode is called its polar effect, because the principal energy or force of such action appears at the two poles where the terminals of the rheophores come in contact with the electrolyte.

The two poles have a still further dis-similarity in the marked difference in the chemical action of each. As the positive pole oxygen and the acid elements are liberated, and with powerful doses it has the effect upon living tissues of an acid caustic, causing coagulation of albumen, a shrinking of tissues and a superficial, dry, white, hard cicatrix, and with a few exceptions, when a bare metal electrode is used there is a corrosion of the metal and a deposit of the metallic salts in the tissues.

Gold and platinum, the "royal metals," are not at all corroded by electrolysis, and aluminum, to but a slight degree, by the negative pole. These are the only exceptions.

At the negative pole, hydrogen and the alkaline elements are liberated, and upon living tissues it has the effect of an alkaline caustic, not coagulating albumen, nor shrinking tissues, but produces a deep, red, moist, soft condition, and when bare metallic electrodes are used there is no corrosion of the metal (except aluminum, slightly), nor deposition of metallic salts.

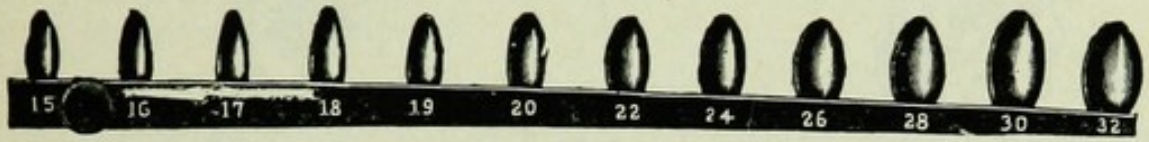
Thus when we see what a vast difference there is between the action of the two poles, we realize how important it is to understand that difference, for if we go to guessing or applying it haphazard, we have only one chance in two of hitting or missing it, and that chance of success or failure.

Now, in moles, warts, corns, papillomata and the like, we have a dense fibrous tissue, and knowing the different action of the two poles, it is easy to select the negative pole to resolve and remove them.

In other conditions, even where we have soft vascular growths to remove, as epitheliomata of the lip or nose, angiomata of the cheek or eyelid, where, for cosmetic effect, we do not wish any scar or white contraction to appear, the negative pole is again indicated, although the positive, at first thought, seems the more preferable.



Nickel plated Urethral Electrode—Flexible with Binding Post.



Urethral Stricture Set, 12 Tips and Base.

Probably the greatest field of usefulness of electrolysis is in the removal of strictures of the various canals of the body. The details and technique of these applications have been more fully detailed before in the part on electro-therapy (pages 70, 71).

There is no one branch or principle in relation to medicine and surgery that is more clean, exact and scientific than that of electrolysis of the living tissues, when intelligently and properly applied.

Electrolysis of living structures is (except dry epidermis and bone) like that of weak saline solutions.

The active electrode is usually a partially insulated needle, which is attached to the negative pole. To the other pole is connected a large surface-electrode (well wetted) which may be placed on any part of the body. The needle is then inserted into the growth and the circuit closed, and electrolysis begins immediately to take place around it.

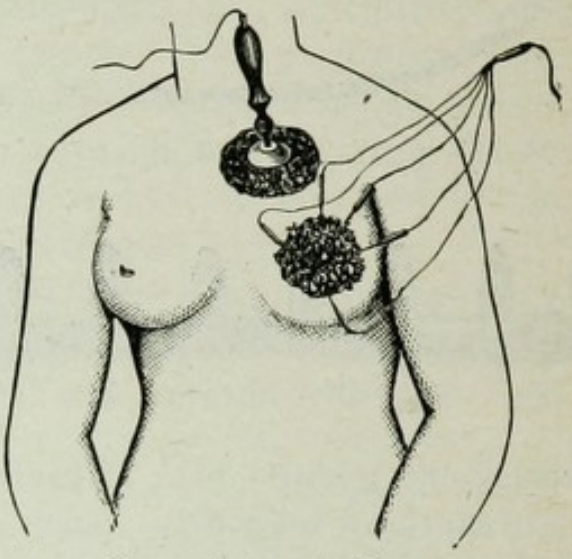
The needle attached to the negtive pole, of course attracts the hydrogen corpuscles and alkaline bases, repelling the oxygen and acids, which are attracted toward the positive pole. There is always an escape during the operation of a portion of the products around the needle, especially of the hydrogen gas, yet there is always a portion of the products retained in the tissues so acted upon, which becomes as foreign matter. The forces of absorption promptly set to work to take up and carry away this disorganized matter, the process being completed in a few days following the operation. Should the growth be small, the one operation, as partially detailed, may complete the removal, provided always that the details have been properly carried out. When the growth is a large one, a proper interval should elapse before a second puncture should be made.

An electrolyte to be susceptible to electrolysis, must be a compound body, consisting of water and a salt in solution.

All soluble inorganic, as well as all organic compounds in solution or in a moist state, are susceptible to electrolysis.



Electrolysis of small growth on face.



Electrolysis of Mammary Carcinoma.

We have shown that the passage of a galvanic mode through water, for a given length of time will decompose a certain volume of the water into its elements. Hydrogen, which is electro-positive, will collect at the negative pole, while the oxygen corpuscles, being electro-negative, will gather at the postive pole, thus corresponding to the old principle in magnetization, that like repels like, but attracts unlike, or positive repels positive, but attracts negative.

This operaion of electrolysis on certain forms of tumors is safer against their return, and also much less disagreeable to the patient, than an operation with the knife. The most delicate and particular work in electrolysis of living tissues is for the permanent removal or epilation of hairs, but which is tedious, requiring great care and accuracy.

The details and technique of epilation and electrolysis in applied electrotherapeutics has been taken up fully in the part devoted to these subjects.

Be cautious about using the mode for electrolysis from a continuous commercial circuit about the face and head, brain and organs of special sense; why? Any interruption of the mode may prove unpleasant if not fatal to your patient. Such interruptions may be caused by the electrician at the station changing circuits from one machine to another, or the grounding of a wire, and melting out the main fuse, as well as various other mishaps.

What effect has anodal electrolysis?

Anodal electrolysis occurs at the positive pole, and is similar in action to an acid application owing to the liberation of oxygen and the formation of acids.

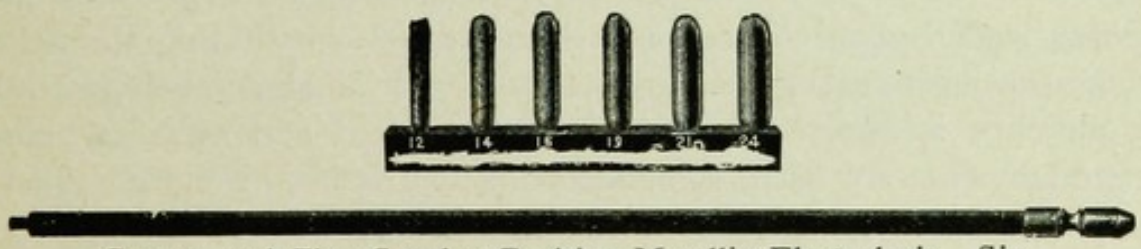
What effect has cathodal electrolysis?

Cathodal electrolysis occurs at the negative pole, and is similar to the application of an alkaline caustic owing to the liberation of hydrogen and the formation of alkalies.

What is metallic electrolysis?

This term is used in electro-therapeutics to designate the use that is made of the secondary products formed at the anode or cathode, when the electrode employed is composed of a substance that will, by uniting with the *ions* set free, form secondary products of some medicinal value. Thus needles, or urethral, uterine and nasal electrodes made of pure copper or zinc and used as the anode, have been found of service by reason of the oxides and chlorides of copper or zinc that are formed at the point of application. By *phoresis,* which is also an effect of the direct mode, these metallic salts are made to penetrate the contiguous tissues for a greater or less depth, and whatever local medicinal effect they possess is thus intensified.

Metallic electrolysis is for obvious reasons almost exclusively a function of the anode. One metal, aluminum, which is frequently employed as a material for making electrodes, is corroded by the alkali *ions,* but it is not yet known that the aluminates of potassa and soda are of any value as local remedies. It must be remembered that such decomposable electrodes should not be used for the anode where a dposit of the metallic salts in the tissues would be objectionable.



Copper and Zinc Set for Positive Metallic Electrolysis. Six Tips and Staff.

In using electrodes with the constant mode for electrolytic effects, ordinarily the action at only one of the electrodes is desired. This is then the "active electrode" while the other electrode, broad and well moistened is the "dispersing electrode" and should be placed on some remote surface of the body, as the palm of the hand, the sternum or the back.

The anode is the "active electrode" in anodal electrolysis. But both anode and cathode can be actively employed at the same time in an electrolytic treatment if the operator so desires.

ANAPHORO-ELECTROLYTIC METALLIC INTERSTITIAL DIFFUSION

What is metallic interstitial diffusion?

We know that the acid positive pole attacks corrodable metals, and an oxide is formed. This unites with the chlorine in the tissues in the form of the soluble chlorides, forming an oxy-chloride of the metal. This oxy-chloride follows the law of polar affinities of unlikes repelling and is driven into the interstices of the tissues, where they exert their chemical properties. This is astringent and antiseptic. The metals usually employed are copper, zinc and mercury. This form of treatment has been found very useful in various forms of acute and chronic conditions, and especially so in the treatment of malignant growths, etc. The method consists of an electric interstitial diffusion into, through and beyond the cells of the malignant growth, of the nascent mercuric and zinc oxychlorides developed within the growth by a powerful electric mode, the patient being under an anæsthetic. These substances are developed by electrolysis from metallic mercury and zinc inserted into the tumor, the pure mercuric salt requiring the use of a gold electrode to diffuse it. These chemical substances are fatal to the germs of cancer, causing an area of total destruction corresponding in extent to the apparent limits of the growth, surrounded by a zone of infiltration reaction within which colonies and prolongations not evident to the senses are destroyed without harm to the healthy tissue.

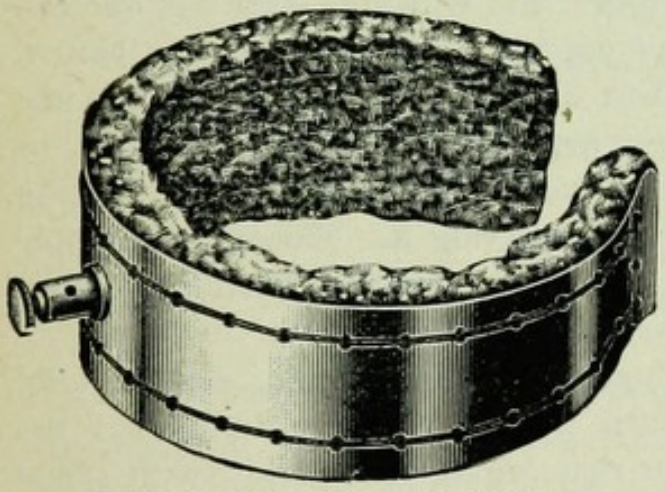
By this treatment the salts of mercury are driven into the cancer by phoresis with heavy electric doses; the patient being etherized and placed on a large leaden plate covered with heavy pads, constituting the negative electrode, the positive being a tube of gold with amalgamated tip through which mercury is injected; three or four hundred and even as many as 2,000 milliamperes are used, sometimes for two hours or more. An inodorous slough separates in from one to three weeks.

PROSTATIC PHORIC ELECTRODE

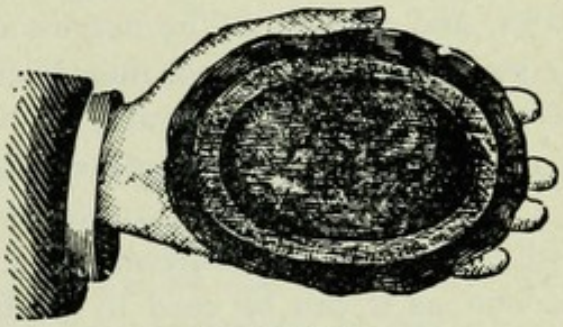


The above cut shows a phoric electrode for treatment of deep urethral

trouble and prostatic enlargement. It consists of a hard rubber catheter, perforated at the distal end for about two inches, with numerous small holes. Inside this is placed a flexible twisted copper wire, around the tip of which is wrapped absorbent cotton, wet with a solution of the drug to be used phorically. The water acts as the conducting medium to convey the drug to the membrane by phoresis. If it is iodide of potash, it is to be connected to the negative pole of the battery, and the effect produced by cataphoresis. If you desire the local effect of the oxychloride of copper, from the wire, then attach to the positive pole, for the anaphoric effect. The other pole of the battery can be attached to a self reaining sponge electrode, either the back electrode shown before, or to a band spring electrode, which holds itself around the leg, as shown in the cut of the electrode below, or held on the skin by the hand pad.



Leg or Arm Band Electrode.



Hand Pad.

SOLUBLE ELECTRODES

What are soluble electrodes, and their use?

For many years it has been almost impossible (not to say impractical) to treat internal organs of the body, on account of having to use metal electrodes, which could not adjust themselves to the irregular walls, villi, and folds which are in abundance in all the cavities of the body, and for this reason I have adopted the soluble process. Taking first the treatment of the stomach. We can readily dilate it with a saline solution, and introduce an electrode through the œsophagus and we have a large electrode covering the entire stomach. This will be an invaluable aid in many cases of dyspepsia and other diseases. And if we wish to concentrate the mode to any one side it is only necessary to place the outside electrode (size to suit) on a convenient spot to secure the proper direction of the mode. Either kind or any mode can be administered with these electrodes.

We call these *soluble electrodes,* not because they are soluble, but because the copper wire in them can be dissolved by chemical action, and will then, in the form of an oxychloride of copper, be diffused through the water, which acts as a positive active electrode. Thus we can apply both the positive sedative galvanic treatment, for the relief of pain, congestion and inflammation, to a mucous surface internally, where we would not dare to apply a bare metal electrode. At the same time we get the positive or anaphoric introduction into the tissues of an astringent, germicide and antiseptic. Thus we get a double action, which in some cases is most desirable and beneficial.

The rectal electrode can be used to great advantage in constipation and neuritis of the abdomen, intussusception, aperistalsis, appendicitis, and many other disordered conditions of the viscera, as the saline water can be forced, not only to dilate the colon, but also reach the small intestines, so that they will also be available as electrodes, and with this electrode one can accomplish decided results that we have not had the means of doing before.

The vaginal soluble electrode. Most of our practicians know that the orifices of the reproductive organs are a network of sensory nerve cells, or plates, and a tonic to the nerves in these parts is like the gardener sowing his seed in good ground, then hoeing and watering it. Thus we can apply electrification to these organs, without feeling that we may burn the patient, or cause any erosion or unfavorable results.

Urethral soluble electrodes for both male and female, can be used with great success, especially in cystitis and other complications of the bladder, as it can be used to wash out that organ, or dilate it, with saline water and then you have converted it into a large electrode. These same electrodes can be used (with care) as intra-uterine, with great success.

The soluble electrode for the ear is a valuable adjunct to the armamentarium of the electro-therapeutist, as you can touch the tympanum with many of the saline solutions with ease, when you cannot touch it by any other electrode, and one that is adept in the use of the modes for disease will readily see the value of these electrodes. Much more might be said about these electrodes, but they will be mentioned later where indicated in therapeutics.

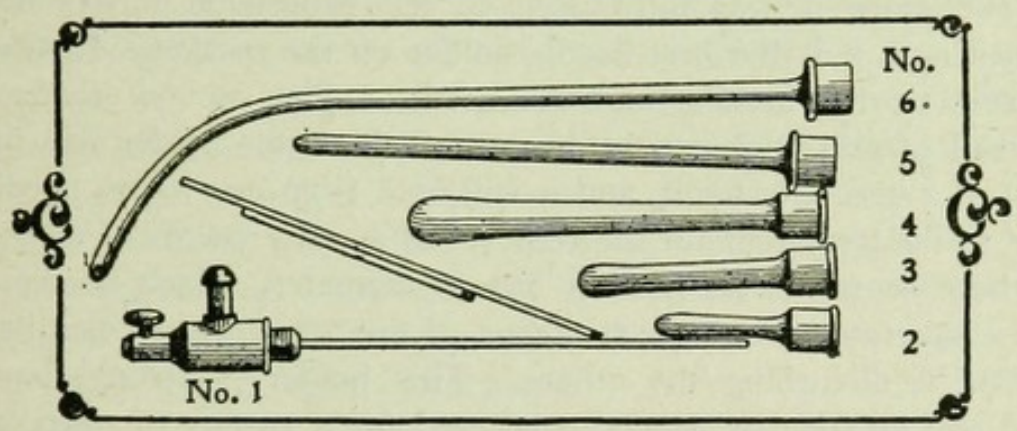
SOLUBLE ELECTRODES

FOR USE WITH THE POSITIVE POLE

There is no known case that requires internal treatment but can be

readily reached by this process, such as inflammation, congestion, strangulation, obstructions, ulcers, erosions, or absorption of pathological conditions. Any medicament can be administered by the osmotic process through these electrodes, as a perusal of the list below will show.

No. 1 is the adapter, and is used to connect both the water and electric supply to the electrodes which screw onto it.



No. 2 for the ear, and No. 3 for the rectum, are used for giving treatment for all aural and bowel trouble.

No. 4 is for vaginal treatment, electric douche, and is a good treatment for leucorrhoea or whites, and inflammation of the vaginal walls and cervix, invaluable in all cases of ulceration and infectious diseases of the female organ. Marvelous work can be done by the application of electrification with this electrode.

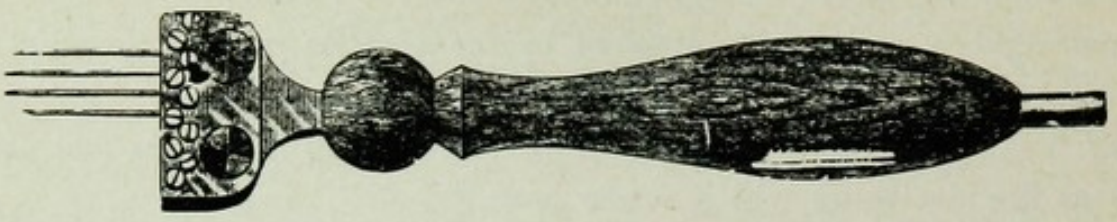
No. 5 is to be passed through the female urethra, and by admitting enough saline water to dilate the bladder, it makes an electrode that is valuable for treating any disease of that organ, as the galvanic mode acting on the salt in the water creates hyperchlorates, which is a germ destroying agent, as well as the action on the copper, which gives off copper oxide, which is a germicide of itself.

No. 6 is the same as No. 5, only is used in the male organ.

These electrodes are made of hard rubber, and protect the mucous membranes from being injured by coming in contact with any metal. Inside is a copper wire which carries the mode; and in connection with the galvanic mode it produces an oxychloride; which is an astringent, germicide and antiseptic agent, and is invaluable in that respect to the practician.

Normal salt solution gr. 2—oz. 1, is used with all these electrodes.

THE BENNETT NEEDLE HOLDER



The above cut shows the first needle holder, invented by Dr. H. C. Bennett, and since it was introduced to the profession it has been improved until now it is the best needle holder on the market. It now has a thumb screw on the handle, and the needle holder is now made in one piece, instead of two as shown in the cut. This needle holder was invented as a result of a necessity for it, and it will hold from one to ten needles, and is adapted to the treatment for the removal of small growths of all sizes and shapes, whose bases are an inch or less in diameter. Each needle is held firmly by a separate screw which allows of one or more needles being removed without disturbing the others. This holder is strong, handsome, well made and inexpensive, and can be used for a variety of purposes. Its uses are well explained in Lesson No. 25 of the mail course of the National College of Electro-Therapeutics, on the "Removal of Small Growths, Superfluous Hair and Blemishes by Electrolysis." This holder is 5½ inches in length, handsomely nickeled, with polished hard wood handle.

Electrical applications which are painful are hardly ever the proper thing.

ELECTRO-THERMO-VAPOR BATHS

How give electro-thermo-vapor baths?

The modus operandi of the electro-vapor bath is as follows:

A suitable cabinet and proper electric connections being at hand, the patient is stripped and put inside, the cabinet closed and the heat turned on, having the pan half full of water. As soon as the skin becomes moistened the electrodes are placed in position and the mode turned on, the patient moving them as desired. After a few minutes, or when the sweat begins to show on the face; the heat is turned off, the mode turned off, and the patient removed, sponged or douched, massaged, and allowed to rest in bed.

RESUME OF THE ELECTRO-VAPOR BATH

What advantages have these baths?

The electro-thermal bath is given in a cabinet, specially designed for the purpose, or constructed to suit the convenience of the physician. In the cabinet, the patient is subjected to the influence of hot air or vapor, and to the electric mode chosen for the treatment.

The patient receives the benefits of either the Russian or Turkish baths, and is, at the same time, submitted to the influence of the physiological and therapeutic properties of the electric mode employed.

The Russian or Turkish bath constitutes the best known means for reducing to a minimum the resistance of the epidermis, thus facilitating the application of electrification to deep-seated organs.

In the thermal bath, the patient is undressed and general electrization is quite easily performed. The general tonic, stimulating properties of general faradization give tone and energy to a system which would be depressed and relaxed by a vapor bath alone.

The Russian bath is a sedative tonic. Blood in increased quantities is brought to the skin, perspiration is stimulated and becomes profuse, poisonous products are eliminated from the system through all the glands of the skin. The nervous system is calmed by the vapor bath and all symptoms of nervous irritation rapidly disappear.

The Russian bath is, so far as elimination alone can do it, the best known blood purifier. The increased cutaneous circulation relieves promptly congested conditions of internal viscera, and allows these organs to continue their functions under more nearly normal influences.

The electric vapor bath is, next to static methods, the best means for producing general electrification. Like static methods, the patient in an electric bath is subject to general electrification, and at the same time the mode may be localized on any portion of the body requiring local treatment. The direct or alternating mode may be used, and the treatment can be made local or general or both combined. This method of treatment combines the effects of hydro-therapy and electro-therapy, and further, it diminishes cutaneous resistance, and permits the use of stronger doses if these be desired, than could be tolerated outside the bath.

Whenever the physician desires to eliminate toxic material from the system, electro-thermal baths are indicated. Tonic sedative effects are also produced at the same time that the toxic materials are eliminated.

The electro-vapor bath is useful for increasing the skin elimination, for its indirect effect on the nervous system, and for lowering the arterial

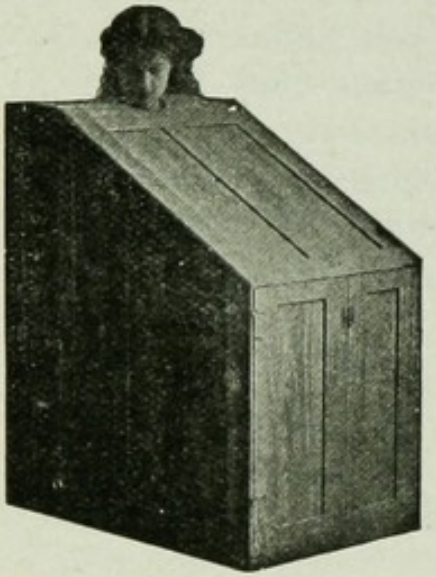
pressure. The addition of electrification gives it a decided tonic effect. The baths are convenient, inexpensive and devoid of the depression caused without the use of electrification.

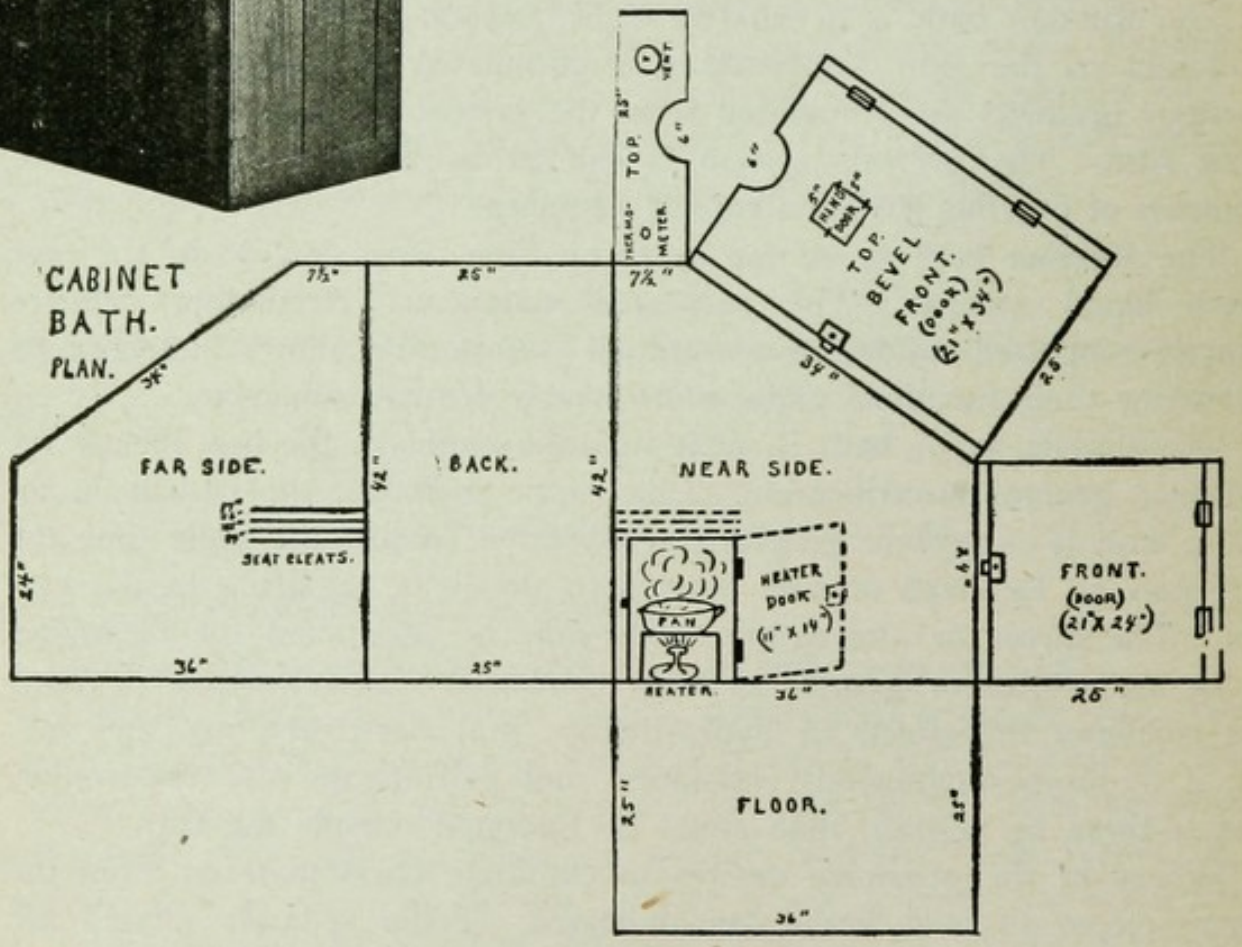
A HOME-MADE BATH CABINET

How construct a bath cabinet?

If it is not desired to invest in an elaborate or expensive office electro-thermo-vapor bath cabinet, one may be constructed by yourself or your local cabinet maker at small cost, and do just as well as one costing a hundred dollars.

I will tell you how to build one yourself. You make it just as elaborate and ornate as your fancy dictates, and the cost will be what you may decide, and it will do just as well as any other.



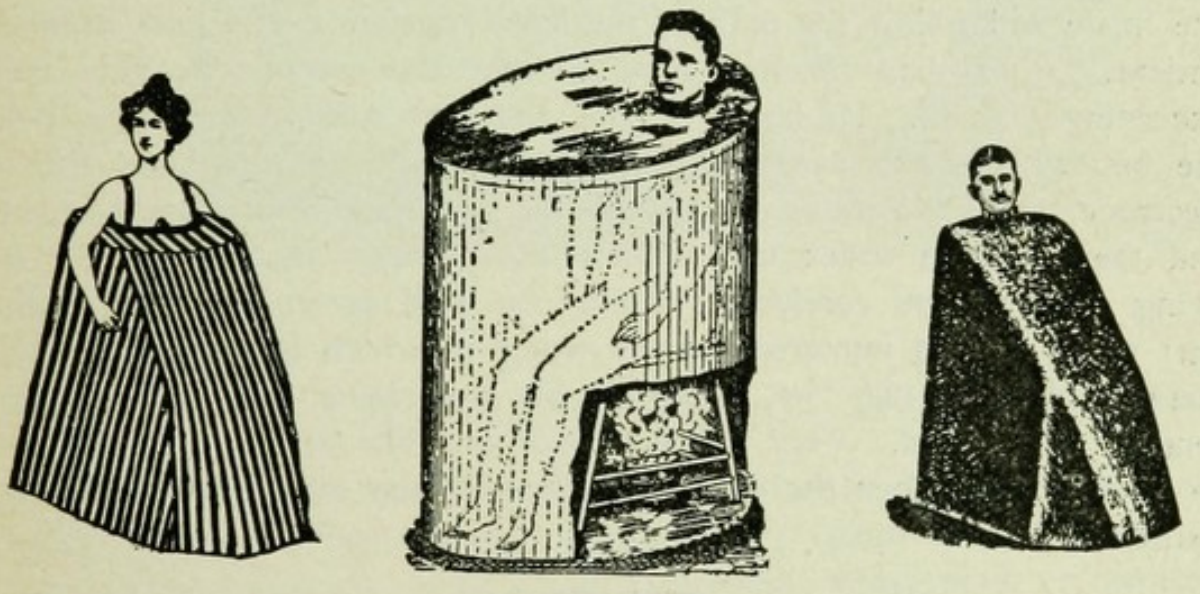


The above sketch shows an outline diagram or pattern of a home-made electro-thermo-vapor bath cabinet. Draw off the plan then fold

along the inside vertical, horizontal and slant lines, and you will have a working model from which any carpenter can build you a bath cabinet.

The dimensions are not exact to the fraction of an inch, but are approximately correct. It should be made of only clear, throughly kiln-dried wood, as the heat will shrink and warp unseasoned wood. The material may be any straight-grained wood and should be at least seven-eighths of an inch thick. The floor may be left off, if desired, and the shell set on an oil cloth, but a floor makes it stronger and it will keep its shape better with a floor, besides fitting it for rollers, if desired. The seat is to be placed on cleats one inch apart so it may be raised through four inches to accommodate different people. One of these will pay for itself many times over. It should have at least three coats of hard paint inside and out, and a new coat every six months, if used much.

PORTABLE ELECTRO-VAPOR BATHS



It is sometimes necessary to give an electro-vapor bath treatment at the home of a patient who may be unable to come to your office for treatment. You may give such cases treatments by means of portable, collapsable baths, similar to the three shown above. Two of these fit about the neck and envelop the body, while the left-hand cut shows one leaving the arms and shoulders exposed. This may be advisable in cases of obesity, where you wish only to heat and deplete the body below the bust. These are cheap and durable and will answer the purpose in cases of necessity and emergency. The patient sits on an ordinary chair with the heater and vaporizer underneath. The material should be some heavy waterproof cloth, similar to cravenette, not rubber or oilcloth, which will crack and

break, and be affected by the heat. This bath may be slipped under the buggy seat, and with your portable battery between your feet and your electrodes in your pocket, you are prepared to administer a beneficial electro-thermo-vapor bath treatment anywhere, in a scientific and satisfactory manner.

THE HYDRO-ELECTRIC BATH

How give hydro-electric baths?

Hydro-electric baths are given in tubs which have no connection with the plumbing. One electrode is put in the water and the dose is thus diffused over the whole of the body immersed in the water. The other is applied to the part of the body out of the water.

Much stress has been placed upon the benefits following the hydro-electric bath, or the bath in which the patient is immersed in water, through which an electric mode is passing. We know that water is a better conductor than the body, and therefore, according to Ohm's law, the mode will follow the path of the least resistance, and pass *around* the patient, rather than *through* him, so that the amount he gets will be exceedingly small. If, however, the water is connected to one pole of the battery and the patient, in the water, holds in his hand the other electrode, above the water, then of course, the mode must traverse his body and the water in order to complete the circuit. Because of the water being such a good conductor, it may be used as an electrode, with the part to be treated immersed in the water in which is one pole. By this method phoresis may be employed by medicating the water with the remedy to be used. Very painful conditions like arthritis and gout may be treated thus, when the contact of the ordinary electrodes would be unbearable.



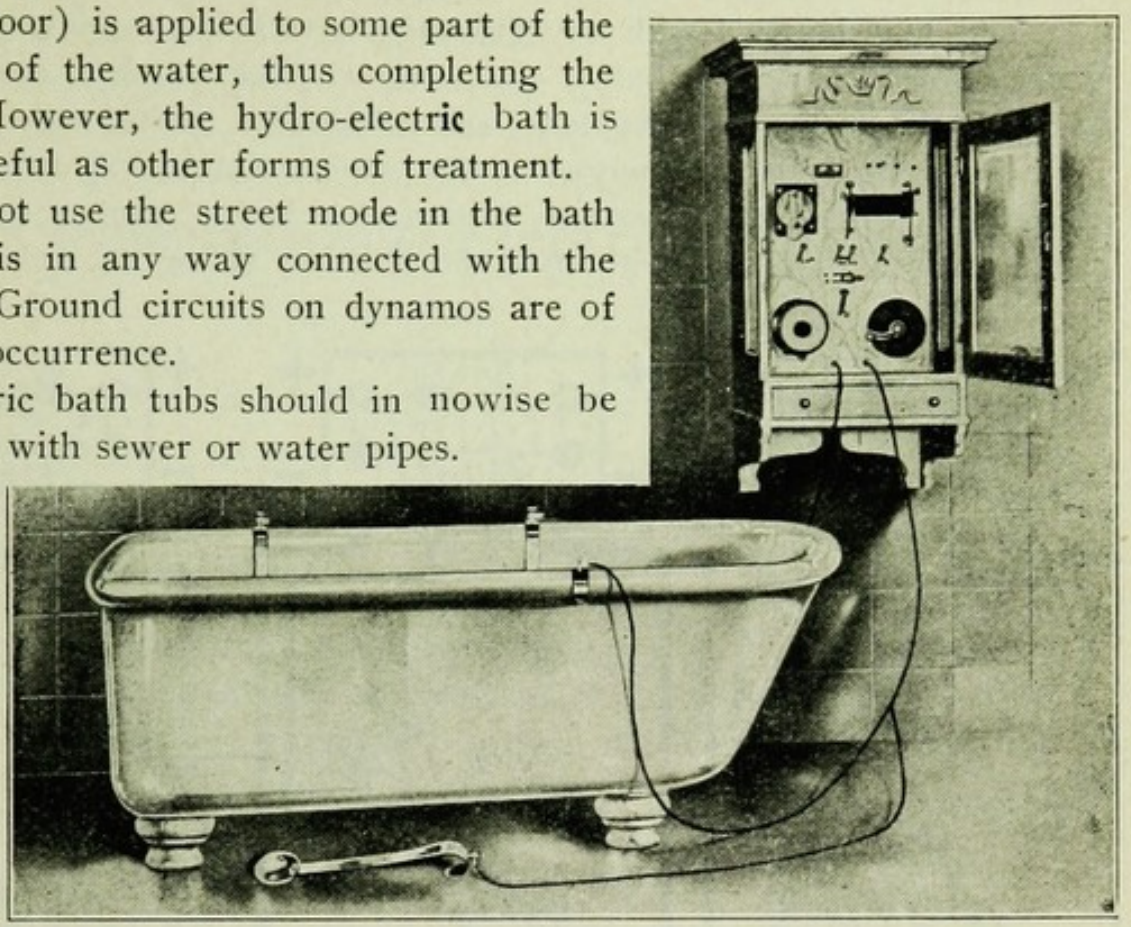
Simple Faradic plate for Bathroom.

The accompanying sketch shows an ordinary bath tub equipped for the hydro-electric bath; one cord from the battery is attached to the sub-

merged electrode, the other pole is connected to the electrode on the floor. The patient's body is either wholly or partially immersed, the water acting as one electrode, and the other (on the floor) is applied to some part of the body out of the water, thus completing the circuit. However, the hydro-electric bath is not as useful as other forms of treatment.

Do not use the street mode in the bath tub that is in any way connected with the ground. Ground circuits on dynamos are of frequent occurrence.

Electric bath tubs should in nowise be connected with sewer or water pipes.



SCHNEE'S FOUR CELL BATH

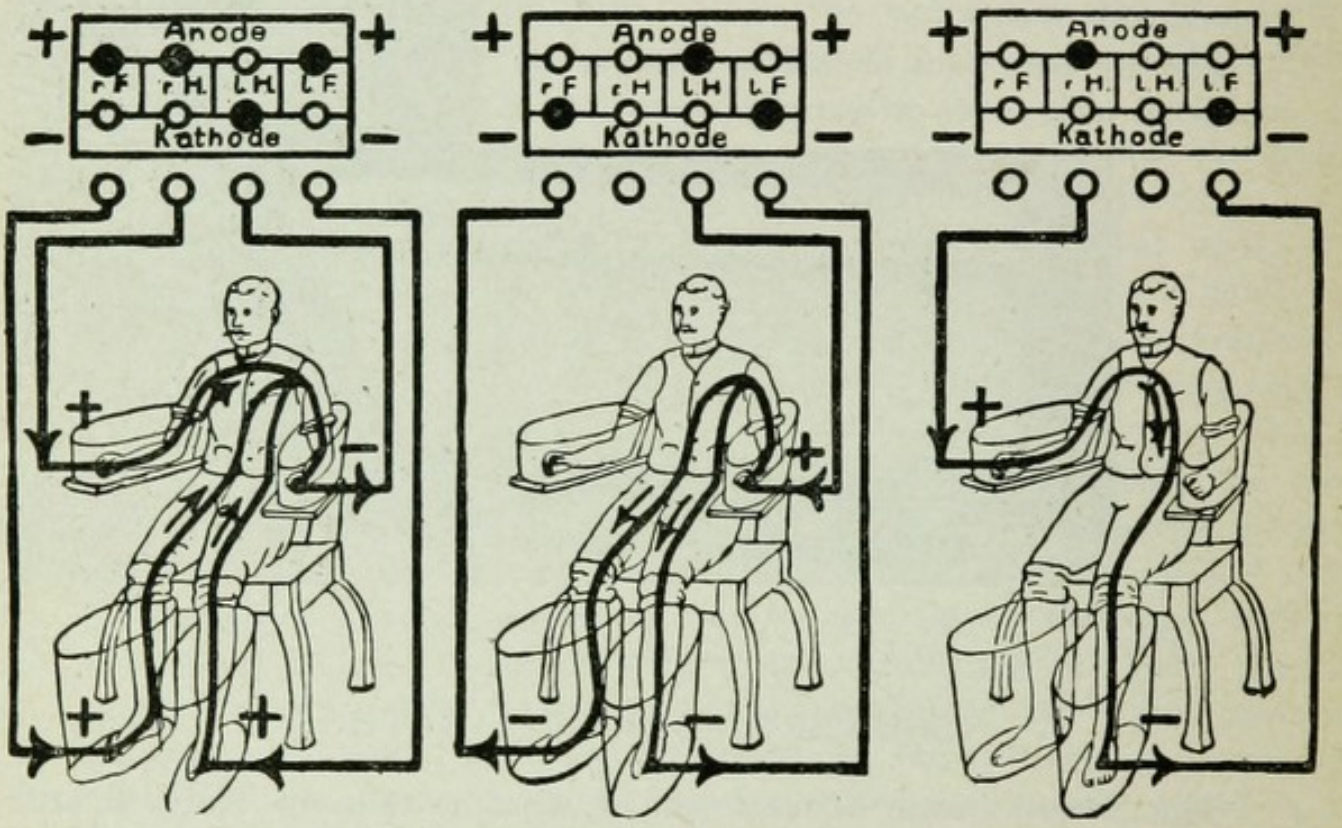
The Schnee system of treatment by what he calls the four cell bath, three treatments being shown schematically (page 184), consists of four glass tubs, which are partly filled with water, either plain or medicated, in which are immersed the electrodes and the patient's hands and arms, and feet and legs, as the case may be. The terminals are connected to a selecting switch or key board, and the modes may be directed in any of one, two or three directions. The right hand drawing shows the connection from the right hand to the left foot, the middle drawing, from the left hand to both feet, and the other, from the right hand and both feet to the left hand.

By this method the different polar effects of galvanization, positive sedation, and negative stimulation, may be localized as desired, and also anaphoresis and cataphoresis may be used separately or simultaneously. An almost endless combination may be worked with this bath.

Prof. Hoffa of Berlin, in a report dated October 8th states that he considers the Schnee system one of the most important steps forward, in the history of electro-therapeutics technique.

This may be used with any galvanic, faradic, sinusoidal, or high frequency generator. It is bulky, and unsightly, but efficient, and especially useful in the gouty and rheumatic, and anchylosed conditions.

The parts being submerged in the water, which acts as a dispersive electrode, enables the operator to treat a larger surface, and use a stronger dose, than could otherwise be given or taken, any other way.



Schnee's 4 Cell Bath.

General Constitutional Electric Treatments

How give general galvanization, and faradization?

General galvanization and faradization is given with the negative electrode to the feet while the positive is moved along the spine and to the muscles in general.

In many constitutional diseases, among which we might name rheumatism, paralysis, neurasthenia, etc., as being more frequently met with, it is necessary to give a treatment that will affect the entire system.

General treatment may be given by general faradization, general galvanization and central galvanization.

GENERAL FARADIZATION

As its name implies, is general use of the faradic mode. This treatment has a direct influence upon the entire system and by indirect action may remotely have a therapeutic effect on some particular organ or part which may be diseased. General faradization is indicated wherever a general constitutional tonic influence is called for, in conditions of depressed vitality, in tedious periods of convalescence, wherever there is poor circulation, defective assimilation and in nearly all nervous conditions.

One pole is usually placed at the coccyx or feet (preferably the latter), the other passed slowly over the entire surface of the body.

The clothing of the patient must be so arranged that the electrode may be passed over every part of the body. Many operators have the patient remove all clothing and substitute a light robe made for the purpose, open either in the back or on the sides, so the active pole may without delay or inconvenience be used wherever it is desired.

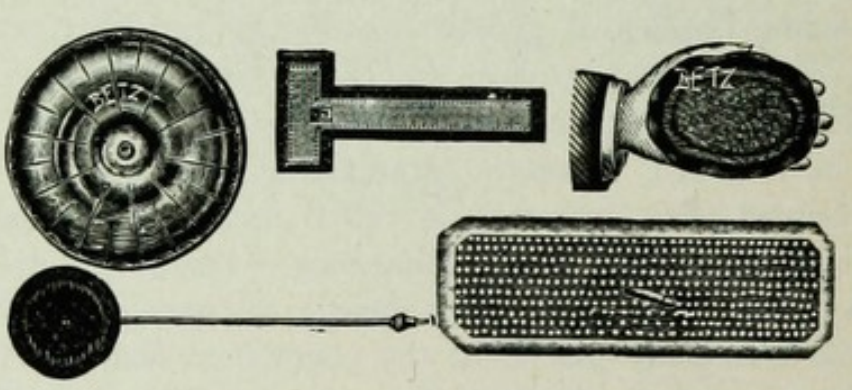
Others loosen all clothing around the waist and arrange to pass a small electrode over the surface, adjusting the clothing separately for each part. In this method there may be less embarrassment to the patient, but

the treatment cannot be given as successfully, the skin can not be moistened as thoroughly, hence the greater resistance to the passage of the mode, and the patient's clothing is invariably soiled and wet by the moistened electrode.

These treatments are given with the patient seated upon a stool so the operator can give a thorough treatment and not be impeded by the arms or back of a chair. The general treatments are also given with the patient in a recumbent position, all clothing removed and the person protected by a sheet or blanket. This is a very easy and efficient manner of making general applications.

In many cases these treatments may be given largely by the patients themselves as far as the manipulation of the electrodes is concerned. If the patient is in an erect position during treatment one wire from the battery may be attached to a zinc or copper plate upon which the feet rest; or the feet may be immersed in a bowl of water and the one pole placed in the water.

In the former method the zinc and copper is frequently unpleasantly cold to the patient, and as the skin upon the soles of the feet is so thick as to afford great resistance, it does not make as good a conductor as the water. The water may be warmed, a little salt added to assist in overcoming the resistance of the skin, and as the water comes in contact with the sides and upper surface of the feet as well as the soles, it makes a much better mode of application.



If the treatments are given while the patient is in a recumbent position, the zinc or copper plate may be used at the feet, or sponge or cotton-covered electrodes preferably attached to the ankles instead of the soles, on account of less resistance.

The question, "Which pole shall be passed over the body?" is the one first asked by nearly every physician and by them is considered the all-important point.

The question of polarity is not of as great importance in the use of the faradic modes as galvanic.

These points, however, may be borne in mind:

If in the treatment of nervous conditions or whenever it is desired to relieve pain, a sedative effect is indicated, the negative pole should be at the feet or coccyx and the positive pole applied over the seat of pain and passed all over the body.

If an irritating or stimulating effect is desired, as for instance in amenorrhœa or paralysis, place the positive pole at the feet or coccyx and pass the negative over the seat of disease and all over the body. In other words the positive pole should be applied to the diseased part where pain is present or active irritation exists; and the negative pole should be used to influence morbid chronic processes. The primary coil would be the preferable one to use where it was desired to obtain relief through muscular contractions, and the secondary coil where it was desired to reach a deeply-seated trouble or treat the nervous system. The peripheral nerves and capillary circulation could be affected to a greater degree by the use of the primary coil; and the spinal cord, the sympathetic nervous system, and the circulation and nutrition of internal organs, or deeply-seated structures could be influenced to a greater extent and with better results, if the secondary coil was used.

Rapid vibrations would be much more preferable in nervous diseases, and slow interruptions in nearly all conditions where a mechanical effect was desired, and violent muscular contractions were to be produced. In this, slow, even, interruptions would be preferable.

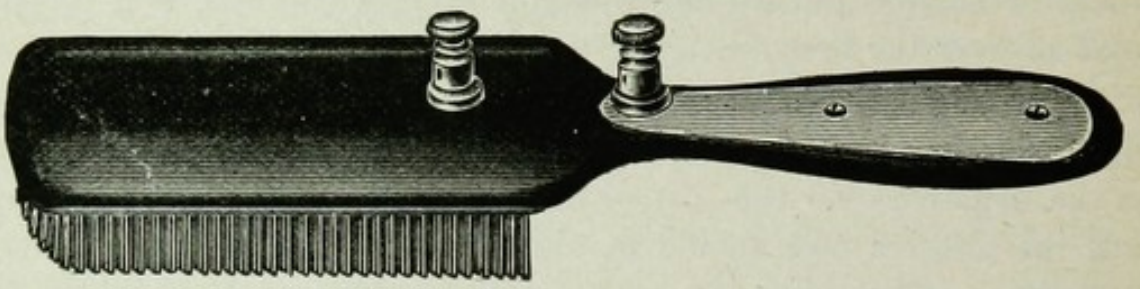
The strength of dose should be regulated by the sensations of the patient. Never carry the treatment to the point of pain. If the patient says it is unpleasantly strong the dose should be reduced.

It is best to begin the treatment of general faradization with the positive pole at the base of the brain, pass it slowly down the spinal cord for three to five minutes, then pass it over the chest and hold it over the epigastrium for a few moments to influence the coeliac-plexus, then over the abdomen to stimulate intestinal action and the abdominal muscles, then upon the thighs, arms and legs, varying the strength of the dose to suit the resistance afforded by the different parts.

In giving general faradization it is important that the treatment should not be neglected at the back of the head, down the neck, the upper portion of the spinal column and over the coelio-spinal center. The most important nerves of the body can be treated here.

In giving treatments to the head it is frequently advisable to pass the

mode through the operator's hand so it will not be felt as plainly by the patient as if the ordinary electrode had been used over the sensitive nerves of the forehead and face. As the hair is practically a non-conductor, it must be thoroughly moistened or a wire brush electrode used.



Hair Brush Electrode (either monopolar or bipolar).

The usual length of treatment is from 15 to 20 minutes. They should be given daily or every other day—very seldom more than once a day.

Any intelligent physician would understand that in the use of these treatments for chorea, neurasthenia, hysteria, etc., particular attention should be paid to the treatment of the nervous system, while in a case of rheumatism we would direct our treatment to a greater extent to the muscles affected.

The effects of general faradization are:

To act as a sedative upon the nervous system, allaying irritability and pain. Sleep is facilitated.

To temporarily act as a stimulant.

To improve nutrition. This may be local or general.

To promote the process of waste and repair.

During and after a course of general faradization the patient will feel exhilarated and stimulated. Tone has been given to the entire system; pain has been allayed; all feelings of weariness, lassitude and lameness removed.

The temperature has been equalized, the circulation improved, and increased warmth given to the surface and extremities, digestion improved and appetite increased and the bowels regulated.

The muscles develop in size and hardness. The body, responding to increased appetite, improved digestion and circulation, increases in weight.

Nervousness is allayed, sleep is facilitated, the brain and mental faculties strengthened and there is a greater capacity for, and endurance of, brain labor.

The good effects of general faradization usually continue for a considerable time after the treatments have been discontinued.

GENERAL GALVANIZATION

General galvanization, or the general use of the galvanic mode, is given in precisely the same manner as general faradization.

Many of the directions given for the use of the poles should be the same.

The differential effect of the two poles is much more marked in the galvanic mode than in the faradic, so that rules laid down for the use of the positive pole to allay irritability and pain and the use of the negative pole where a stimulating or irritating effect is desired should be more particularly observed.

Some authorities attach more importance to general faradization than general galvanization, while with other authorities this is reversed. Either treatment would be of benefit in the same conditions.

Galvanization has the advantage that stronger doses can be used, that it has greater penetrating power and will reach a deeply seated trouble where in some cases the faradic mode would be ineffective, and that it has a chemical effect which the faradic mode does not possess.

To produce muscular contractions through general galvanization it would be advisable to use the interrupted galvanic mode.

Ordinarily general faradization would be preferable in muscular trouble and general galvanization in nervous diseases. The sedative effect is much more marked in the latter treatment than in general faradization, as is also the effect upon the absorbents.

The general nutrition of the entire system can probably be more profoundly affected through general galvanization than by general faradization. Either treatment is successful in influencing the circulation.

In giving general galvanization, care should be taken that the mode is not suddenly interrupted while the electrodes are in position, as this causes a shock to the nerves which may aggravate the trouble. The treatment cannot be properly given without the use of a rheostat and milliampere meter.

CENTRAL GALVANIZATION

How give central galvanization?

Central galvanization is given with the negative electrode over the solar plexus, the positive being moved over the head and spine, and over the pneumogastric nerve in the neck.

By this term we mean a treatment with the galvanic mode which

will bring the entire central nervous system—the brain, sympathetic, and spinal cord—under the direct influence of the treatment.

This treatment may be given independently of any other, or co-jointly with general faradization or galvanization, and is applied by having one pole, usually the negative, at the epigastrium and the other at the vertex or passed over the forehead, down the back of the neck, and down the entire length of the spine. Having the negative pole at the epigastrium and the positive pole at the base of the brain and down the sides of the neck is the best method of stimulating the sympathetic, pneumogastric and phrenic nerves. Over the forehead not more than from two to five milliamperes should be used, while upon the vertex and down the spinal column, 10 to 15 milliamperes is the usual strength of dose, although this may be increased to 25 or 35 in many cases. Treatments to the head should not be continued more then two or three minutes at a time.

Particular care should be taken in treating the head that there is not a sudden interruption of the mode. The electrodes at the epigastrium should cover considerable surface to prevent any pain or burning sensation.

The length of treatment is from 12 to 15 minutes.

Central galvanization would be the indicated treatment wherever there is a condition of exhaustion or irritability of the nervous system. It is usually a good idea to combine central galvanization with general galvanization or general faradization. In nearly any patient who would come to us suffering with hysteria, neurasthenia, chorea, epilepsy or analogous conditions, where we desire to use central galvanization we would also find in one case defective assimilation, in another rheumatism, and in others constipation, muscular atrophy, the results of lagrippe, various skin diseases, and so on ad infinitum, and these outlying symptoms or conditions could be removed or improved by general treatment, while the central treatment alone would effect little if anything.

The central treatment and the general treatment may be given on alternate days; or, what is a better plan, give the central galvanization ten minutes and then general faradization or galvanization ten minutes more, during the same sitting.

Central galvanization and general faradization have in the effect of the treatment many things in common. With either treatment a feeling of exhilaration and warmth of body is produced. A tonic effect, improvement in sleep, increased appetite, improved digestion, regularity of the bowels and equalized circulation may be secured with either treatment, as can also increased size and firmness of the muscles.

Either of these treatments, both by direct effect and indirect action, will act as a tonic to the brain and increase the capacity for brain work. General faradization, however, acts more markedly upon the muscular system and central galvanization upon the nervous system.

What effect has electrification on the blood and strength?

Electrification has not only a direct effect upon the circulation, through the catalytic action on the vaso-motor nervous system, but it also has a marked effect upon the constituents of the blood itself, and we find, after careful experiment and observation, that the increased circulation and oxidation of the blood lessens the number of red blood corpuscles. These corpuscles must have gone into the tissues in the form of nutrition. At any rate experiment shows that the muscles are stronger after a treatment by electrification than they were before.

What are the four classes of electrification?

Electrification may be divided into four classes, according to the various phenomena of manifestation, as follows:

1st.—Electrification in motion, or dynamic.
2nd.—Electrification in rotation, or magnetic.
3rd.—Electrification at rest, or static.
4th.—Electrification in vibration, or radiant.

How is the static mode generated?

Static modes are generated by friction and induction as we know from experiments with the box, glass, paper, comb, etc., or a pan of sealing wax which, rubbed with a piece of fur or silk, will become charged. If a piece of metal, with an insulated handle is held upon the wax it also will be charged and will carry the charge with it when removed, and when touched will emit a spark.

The modern static machines are mere elaborations of the simple electophorus which have been adapted for developing electrification continuously. With a number of glass, hard rubber, or mica plates, placed vertically, and so arranged in pairs that the charges of the same polarity are conducted to the same terminal on one side of the machine, and the charges of the opposite polarity to the same terminal on the other side of the machine.

The static machine is constructed with one or more pairs of plates,

mounted on an insulated axle, with two insulated metal rods connected with the plate. The ends near the plate terminate in toothed collecting combs, while the other ends terminate in balls. The mode is generated by starting the machine in motion. If it be of the Toepler or self-charging type, which has six small disks cemented to the plates, when the brushes come in contact with these small disks as the plate is revolved past the brushes it causes a slight friction, which generates the initial charge, which is communicated to the other plates, thus charging the machine and keeping it charged. After being charged the induction keeps up the generation.

As the plate rotates, a part of the negative charge is carried over to the inductor, thus charging it negatively. The remainder of the charge being repelled by the negative, passes over into the Leyden jar. Later it becomes charged by induction, this time positively, increasing the positive charge upon this inductor, while the remainder of the positive charge passes over to the Leyden jar, and passes on to complete the cycle.

As the rotation continues the plates acquire stronger and stronger charges, the inductive action becomes more and more intense, the positive and negative charges are continuously imparted to the Leyden jars or prime terminals, the stress of the high potential becomes so great as to overcome the resistance of the surrounding elastic transparent dielectric (the air) when there is a convective discharge in the form of a spray or a disruptive discharge in the form of a spark across the gap between the prime poles. This temporarily relieves the stress, and the same process is repeated.

Friction between two bodies causes a separation of electrification. One body becomes positively, and the other negatively electrified.

In this condition they are mutually attracted to each other. If two bodies similarly electrified are brought into proximity, the ones of the same polarity are mutually repelled, while the ones of the opposite polarity are mutually attracted.

There is a mooted question as to whether the electric charge of any conductor simply resides upon the surface or penetrates into the substance or the tissues of the body, in the case of a patient. No matter which theory is true, the results in therapeutics are the same, so that we need not discuss that matter.

What are condensers?

Condensers are apparatuses consisting of two conductors, supported and insulated from the earth, and separated from each other by some die-

lectric, or non-conductor. This intervening dielectric may be the air, glass or other insulator. If one plate is charged with one polarity there will be induced in the other an opposite polarity. Glass as a dielectric will induce a greater potential in the second plate than will the air.

The condenser most used is called a Leyden jar, which consists of a jar or bottle of glass lined on the inside, part way up from the bottom with tin foil, and covered for the same distance on the outside with the same material. The inside coating is connected to a ball on the top of the lid, by means of a chain. If the inside foil be charged with positive static electrification, there will be induced on the outside coating of foil an opposite or negative charge.

How is static capacity modified?

The capacity of a conductor of static electrification depends upon the degree of insulation, against the loss of charge by leakage, and upon the size of the conductor, or patient, and upon the state he is in at the time of treatment, and also upon the proximity to the generator.

How is static electrification governed?

Static electrification is governed by the same laws of conduction and insulation as is the dynamic modes, but to a less degree because of the far greater voltage and very weak amperage. On account of its voltage, much greater insulation is required, and a correspondingly poor conductor will carry a charge. Thus a small air space will insulate a galvanic mode but a wide air gap will be leaped across by a static charge.

How is static electrification distributed?

The distribution of the static charge of electrification is uniform, all things being equal, and the potential of any part of a perfect sphere is equal to that of any other part, but this is not true of irregular conductors, as the density of the charge or the potential varies according to the curvature of the conductor.

Thus, a discharge will not be as marked from a flat part of the body as it will from some bony prominence, therefore we must be careful about drawing charges from the smaller parts of the body, as there the conductivity is lessened, and the effect is more marked. This modality therefore, follows the same law of density and diffusion as do the other forms studied in previous pages.

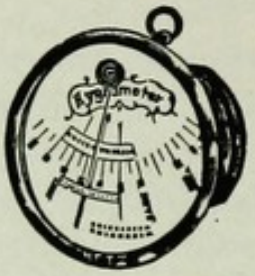
What can be said of static polarity?

The same polar effects are manifested here also, in that the positive is sedative and anodyne, and the negative is irritating and stimulating.

What is the difference between static and faradic induced modes?

The static induced mode is not of the alternating character of the faradic induced mode. Instead, it is a unidirectional mode, but interrupted at the same rate that the primary static mode which induced it, is interrupted.

Of what use is the hygrometer?



The hygrometer is a little instrument which is placed in the case of the static machine. It indicates the percentage of moisture in the air, and tells the operator why his machine works badly, and when to dry it out.

What is the physiological effect of static electrification?

The static mode produces no chemical effect in the tissues, it acts as a general tonic and stimulant to the nervous and circulatory systems. It will increase the circulation, improve nutrition, assist digestion and assimilation, promote absorption, quiet, refresh and invigorate the nervous system.

On account of its great voltage it puts the surrounding air in a state of great stress, liberating allotropic oxygen, which in the form of nascent ozone is inhaled or absorbed through the skin and enters directly into the circulation, thus increasing oxidation. In acute painful conditions, as lumbago, sciatica, locomoter ataxia, etc., static electrification affords a great measure of relief. Being a sedative, the positive static modality is indicated in all nervous functional disorders. As a counter irritant, the negative modality is useful in breaking up adhesions and promoting absorption.

As a stimulant to paralyzed muscles we have in the static modes a most active agent, producing active contractions, whether due to lack of tone, partial or complete paralysis. In painful and diseased conditions, and where metabolism is to be stimulated or elimination and excretion hastened, or as a restorer of the normal electric equilibrium, it probably acts more generally and quickly than anything else.

Also in all states of poor nutrition, and impoverished blood, it is valuable. The great voltage puts the surrounding air in a state of stress, and breaks up the combination of the gases, liberating allotropic oxygen, which in the form of ozone, is inhaled or absorbed through the skin, and enters directly into the circulation, in the nascent state, thus rapidly increasing oxidation, and purifying the blood, and thus promoting nutrition, and growth. A patient on the insulated platform, is bathed in this ozone bath, and as a result, in a few minutes, the body temperature is raised from a degree to a degree and half, and the blood pressure increased.

This fact can be easily demonstrated, with the aid of a clinical thermometer, before and after a treatment by static insulation. Static treatments will also tone up and restore the balance in cases of depressed nervous functions, as in neurasthenia, and in various cachexias.

Mental exhaustion, brain fag, and the subnormal states following prolonged literary labor of teachers, lawyers, clergymen, physicians, public speakers, etc., respond most favorably to the gentle but powerful stimulating effects of static electrification. In rheumatism, gout and uremic states it acts well, relieving the pain, and hastening the absorption of deposits, and the elimination of urea.

The positive breeze relieves congestion when the positive pole is used, and, being a sedative, is indicated in headaches, epilepsy, neurasthenia, hysteria, etc. The static spark is a stimulant, producing counter irritation, and is useful in ganglia, rupture, and in breaking up adhesions and in aborting acute rheumatism, etc.

Static electrification is useful in convalescence after operations or prolonged illness, tuberculosis, neuritis, tic douloureux and constipation.

While static electrification produces no chemical effects in tissues, it will increase the circulation, raise the blood pressure, improve nutrition, assist digestion and assimilation, promote absorption, and quiet, refresh and invigorate the nervous system.

In neuralgias, and the acute painful troubles, as lumbago, sciatica, the lightning pains of locomotor ataxia, and in migraine, and "tic" it affords a great measure of relief, sometimes almost like magic.

In many relaxed nervous conditions, it is beneficial, and it will some-

times prevent epileptiform attacks, when all else fails. In chlorosis and anæmia, and in incipient tuberculosis, the results obtained are sometimes marvelous. Poor circulation, as evidenced, by cold feet, clammy and pale skin, can sometimes be changed in one or two treatments. A dozen inhalations of the fresh nascent ozone, will flush the face of a pale patient to a rosy red, and a static roller massage application, through the clothing, will warm the patient all over for hours, and the roller or sparks to the soles of the shoes will take away the cushion sensation, in threatened paralysis. Static treatments will relax contracted and drawn and even stiffened muscles and points, and fill out atrophies. In the vague and troublesome symptoms incident to the menopause, static electrification is very satisfactory.

As a stimulant to paralyzed muscles it is the remedy to be used, as it will produce active contractions without pain, and in constipation, due to lack of tone or to paralysis from over distension, or the prolonged use of cathartics, there is nothing better. It may be applied even to children, sensitive women, and weak convalescents, without pain, and the peristalsis is at once started, and in sometimes continues for hours after the seance.

There being no direct chemical, electrolytic, or mechanical or phoric effects, then the great and grand function of static electrification is the catalytic effect on nutrition, through the vaso-motor nervous system.

In giving dynamic electrification, we must necessarily make the treatments largely local, whereas we can rarely make a static treatment local. When the patient is on the insulated platform, we may concentrate the most of the effects to some part, or local area, but we cannot prevent the excess from traveling all over the patient, thus giving him a general treatment at the same time.

With a proper diagnosis, and a full realization of the needs of the individual case, and a full knowledge of the technique of the treatments, the man with the static machine can accomplish wonders, and do it so safely, quickly, and pleasantly, and withal so profitably to himself, that he will no longer resort to the older and slower, and more disagreeable methods of the past, when once he gets started in the new ways.

Do not get the idea that the static electrification will do everything, or that it is a cure-all, or that it will take the place of galvanism, or faradism, or drugs, in all cases. If you start out with the idea, you will be disappointed, and are only laying up for yourself trouble. Static electrification has its place in our work, and in many instances it has a place which nothing else can fill. Use it in conjunction, or in alternation, with the other modes and get a combination which cannot be excelled.

There are some advantages in giving this treatment over all others. It may be applied, either generally, locally, or both, without disrobing, exposure, or the annoyance of delay. For this reason it is popular with the women, who are usually our best patrons. Again the treatments take less time, as there is none lost in preparation before or after the treatment. Then you may treat a number at a time if desired. For instance, the platform is usually large enough for two stools upon it, or a mother may hold her child on her lap. You may treat infants this way, which you could not do with any other method.

In static electrification, we possess one of the most useful agents for the relief of painful and diseased conditions, and when properly applied, will usually prove beneficial, and where tissue metabolism is to be stimulated, or elimination and excretion to be hastened, there is probably nothing superior.

As a restorer of the normal electric equilibrium, it probably acts more generally and quickly than anything else. Generally catalytic or nutritional effects are more quickly produced with static, than with the other modalities.

The use of static sparks ought to be discouraged. The static breeze will usually do what sparking can do, and is by far more agreeable.

What are the ten therapeutic static applications?

The various modes of static treatment are:

Static insulation, or bath; static crown breeze, or shower; localized static spray; diffused static breeze; direct spark; indirect spark; solenoid shunt mode; surging, or static wave; general tonic treatment, with roller; induced mode, or Leyden jar shocks; interrupted continuous mode or static vibration.

What size and kind of static machine is the best?

A sixteen plate machine will be amply sufficient for all ordinary static therapeutic work, and will do good X-ray work, but for the more difficult X-ray work you should have a twenty-four plate machine. This is especially so in wet weather, when the machine works at a disadvantage and will not deliver its full potential charge of electrification, on account of leakage, through the moisture in the air, which will condense on the plates in the form of dew and, acting as a conductor, will short circuit the

machine inside. It is well to always make it your rule never to leave the machine short circuited when not in use, that is never to leave the balls on the sliding rods of the prime conductors in contact. Always leave them wide apart, beyond the sparking distance, when not in use. I have had experience with nearly every kind of static generator, and have found the Tœpler, or self-charging type, to be the most satisfactory, and the twenty-four plate the best. The roller bearing shaft machine, for ease of running, strength of construction, and economy of repairs, is far superior to all others.

What can you say of static voltage and amperage?

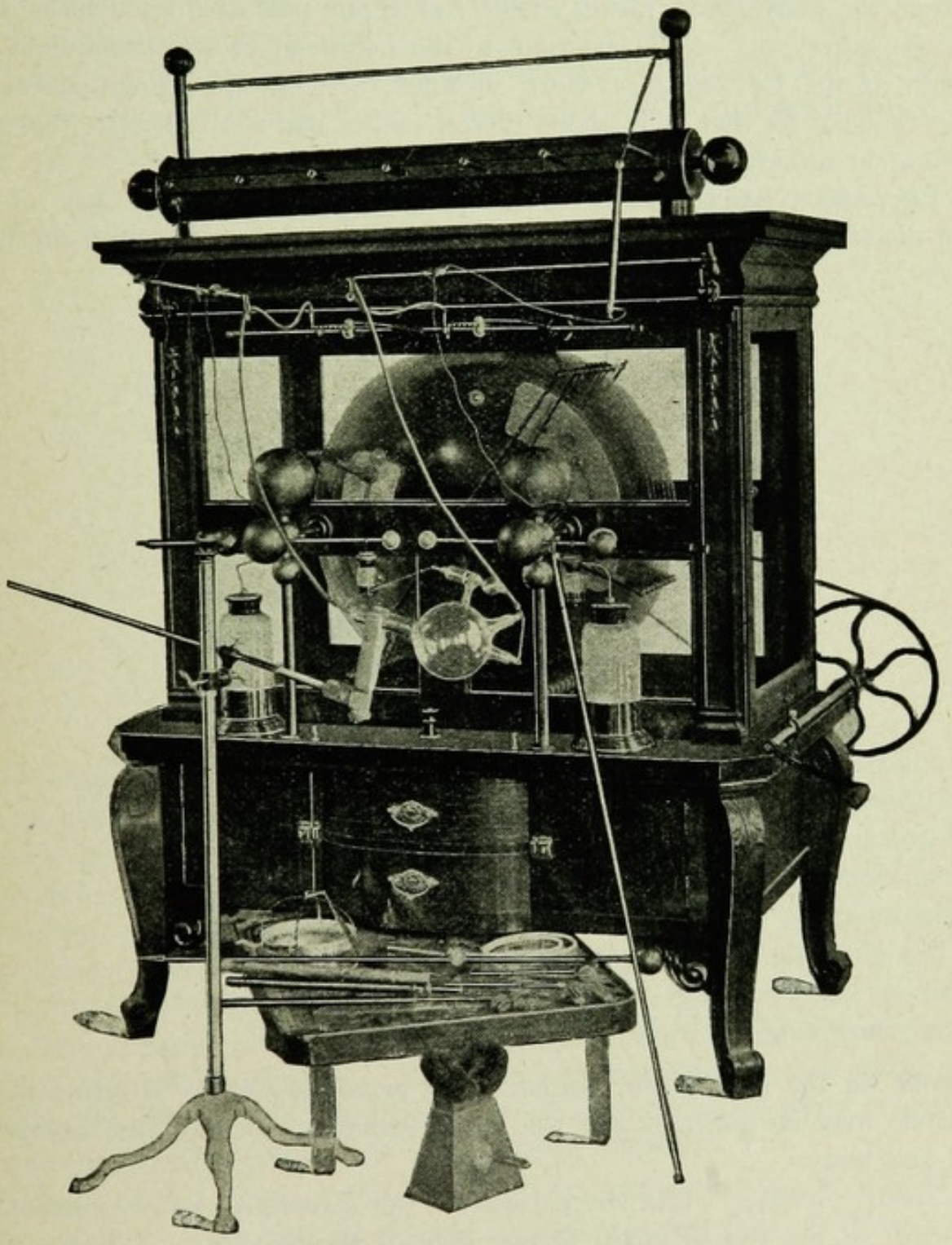
Static electrification manifests enormous pressure or voltage. This is shown by its ability to overcome great resistances, and to pass obstacles which would effectually check the weaker dynamic modes. We have seen that in order to get a galvanic or a faradic mode, we must have a complete metallic conducting circuit. Such is not the case with the static, as we are able to give treatment with only one pole of the static machine.

Dry air is a poor conductor, and is a sufficient insulator for even high pressure dynamic modes, but the static machine will generate a potential sufficient to overcome or break down the great resistance of the air dielectric, and cause a spark or discharge to take place through long gaps between poles, or from the machine to the earth. The principle of the difference of the potential, as creating a transference of energy from the higher to the lower, is applicable to the study of the phenomena of static electrification. Thus we speak of the static mode flowing in the same sense that we say the same of the other modalities which we have studied.

Static electrification manifests no strength or amperage and consequently will cause no chemical action, and will not produce electrolysis or dissociation of compound electrolytes. For the same reason it will not have any phoric action. This statement may be disputed by some, but we now know that if there is any transference of medicaments, it is not a phoric process, but merely a repulsion of electrified particles, which must be either a vapor or a gas, and will not penetrate the tissues.

STATIC TECHNIQUE

Directions for Giving the Various Treatments.



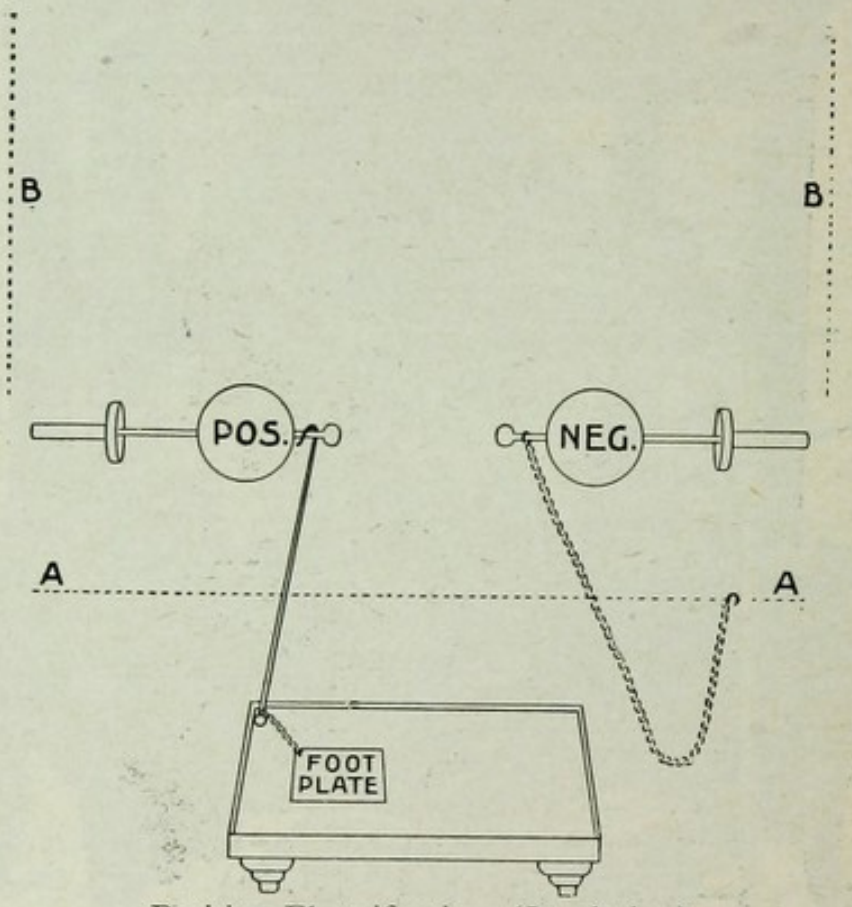
A Modern Static Influence Machine.

STATIC INSULATION—Place the patient on the insulated platform. Connect the platform by means of the rod, cord or chain to one pole of the

machine. Ground the other pole of the machine by means of the chain or cord attached to the water pipe. Separate the sliding rods beyond the sparking distance. Short circuit the outside of the Leyden jars. Start the machine in motion.

Static Crown Breeze—Place the patient on the insulated platform. Connect the platform by means of the rod to one pole of the machine. Connect the other pole of the machine to the overhead crown attachment, the outside of the Leyden jars short circuited. Swing the crown above the patient's head so that it is about fifteen inches above the head. Start the machine in motion.

Localized Static Spray—Insulate the patient, attach any of the point electrodes to the chain or cord and localize the breeze with the point



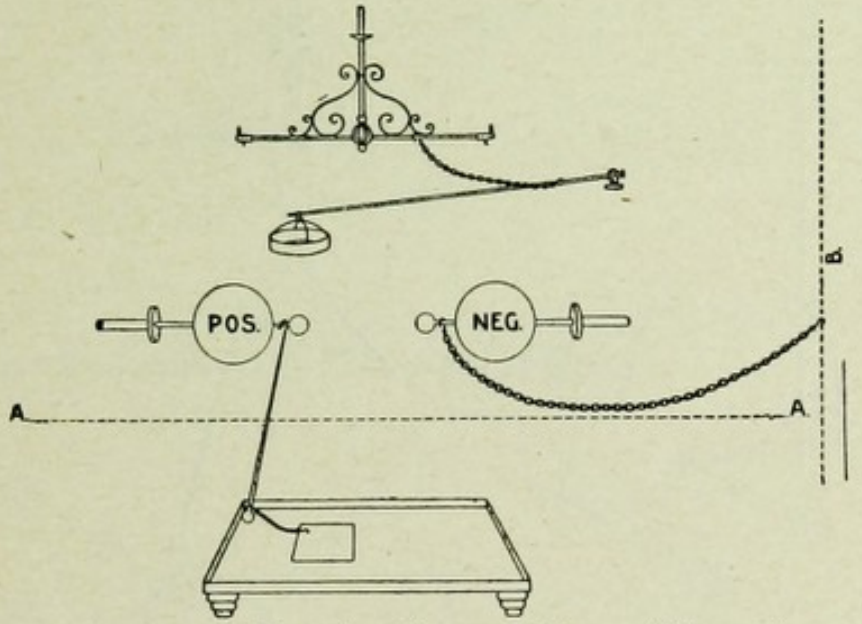
Positive Electrification (Insulation).

electrode on the part to be treated. The grounding chain attached to the electrode may be omitted, and the mode grounded through the operator's hand and body.

Direct Spark—Place the patient on the insulated platform connected by means of the rod or chain to one pole of the machine. Attach any of the electrodes by means of the hook and chain or cord to the other pole of the machine, holding the electrode in the left hand, and using the insulat-

ed hook to hold the chain away from the patient and the floor. Approach the electrode to the part to be treated, from which the sparks will be drawn.

Indirect Sparks—Place the patient on the insulated platform connected by means of the rod to one pole of the machine. Ground the other pole by means of the cord or chain attached to the water pipe, with any of the electrodes either grounded to the floor by means of the chain or the electrode held in the hand, grounding the circuit through the operator's body, and approach the electrode to the part to be treated from which the spark will be drawn.



Stationary Negative Crown Breeze (Shower).

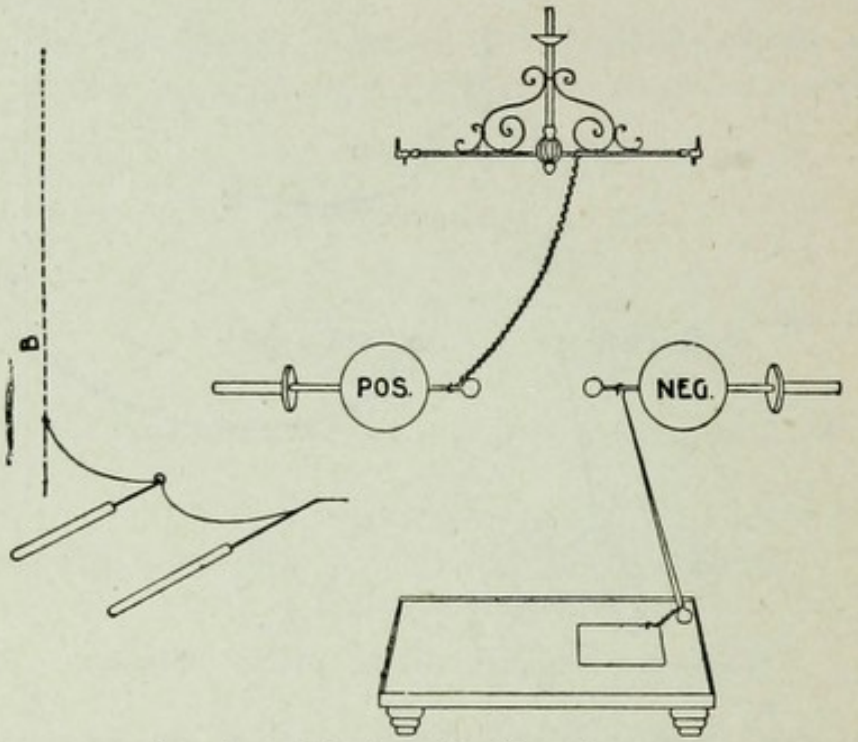
Interrupted Direct Mode—Place patient on platform; connect a wet sponge-covered electrode to the positive side of machine (with positive sliding rod drawn out) by an insulated cord. Place electrode on bare skin wherever you wish to get a sedative effect. Likewise place another wet sponge electrode on bare skin wherever a stimulating effect is desired. Then connect this electrode to the negative X-ray spark gap, the rod and ball placed on a level, and in line, and in contact with the negative sliding rod. The negative prime pole not grounded. Start machine and regulate impulse through patient by pulling out negative sliding rod, away from negative X-ray terminal. The length of this gap regulates effect on patient. Grounding negative prime pole increases the effects.

To Use The Concentrator—Place the patient on the insulated platform connected by means of the rod or chain to one pole of the machine, the other pole being grounded by means of the chain or cord attached to the water pipe. Place the point of the concentrator on the standard, to-

wards the part to be treated, the concentrator being grounded by means of the chain attached to the water pipe, or by means of the hand and body of the operator.

SURGING—Proceed the same as in the static insulation, but bring the sliding rods within sparking distance, the strength of the surging being regulated by means of the spark gap between the sliding rods.

GENERAL TONIC TREATMENT—Place patient on insulating platform, connect one pole of the machine by means of the chain to metal foot plate on the platform, covered with a thin book, on which the patient's bare feet



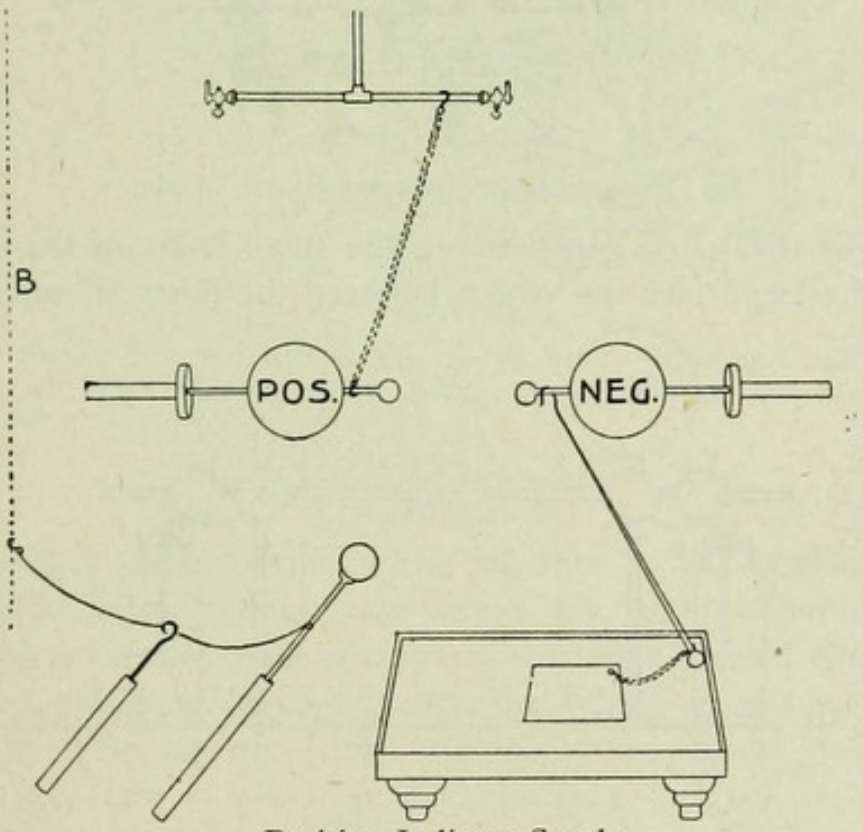
Local or Moving Positive Spray.

are placed. Connect the other pole of the machine to the overhead crown the same as in static breeze. This treatment may be used as a variation of the static insulation, static breeze and surging.

VARIATIONS OF STRENGTH—To get the mildest treatment, use the smallest Leyden jars, run the machine slowly, and give either the static insulation or the indirect breeze, with the wooden point electrode. To give the most severe treatment, run the machine very fast, and give the direct spark with the large metal ball or roller.

INDUCED MODE—Remove the concentrator from the standard. Place in the standard the induced mode service. Place the standard and device directly in front of the machine with the device parallel to the sliding rods with the scale to the front. Disconnect the outside of the Leyden jars. Separate the sliding rods beyond sparking distance. Connect the sliding rods by means of two short chains and hooks to the binding posts

on the device. Attach the sponge covered disc electrode to the binding posts in front of the Leyden jars by means of the red and green silk-covered cords, the sponges well wet. Apply the sponge covered discs to the part to be treated, preferably to the bare skin, but it may be given through the clothing. Start the machine and regulate the strength by means of the wheel on the device. The static induced mode may be applied with any of the other electrodes, with the patient either upon the insulated platform or not.

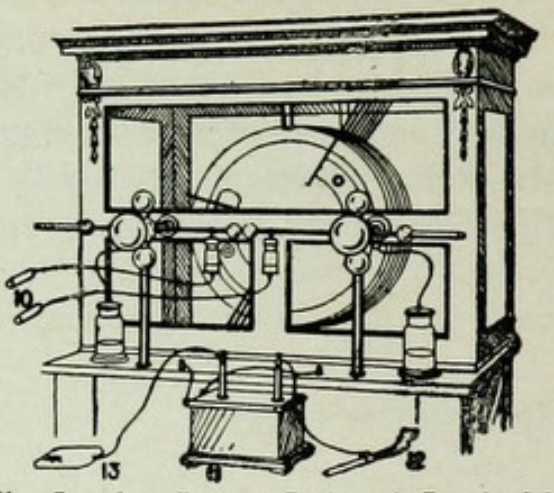


Positive Indirect Spark.

If you do not have the special induced mode regulating device, the mode may be given without it, by connecting the cords from the electrodes to the outside of the Leyden jars, and bringing the balls on the sliding rods together, with the outside of the jars not connected to each other (switch open). Then start the machine and regulate the secondary or induced mode, by the primary mode. To do this, gradually separate the sliding rods, the spark gaps between the sliding rods regulating the impulses through the patient, in the induced mode circuit from the outside of the jars.

Suspend the small pair of Leyden jars on the sliding rods of the prime conductors, and connect the bottom of one of the jars with the roller electrode and the other jar to the foot plate on platform. Or connect both jars with a pair of metal hand electrodes, or any other electrodes that

may be desired. When the large jars are used, the connections are shown in the accompanying cut. The jar mode or the static induced is regulated



The Leyden Jar or Induced Static Mode.

by the length of the spark gap between the small balls on the sliding rods. When using the large jars the switch between the posts should be open.

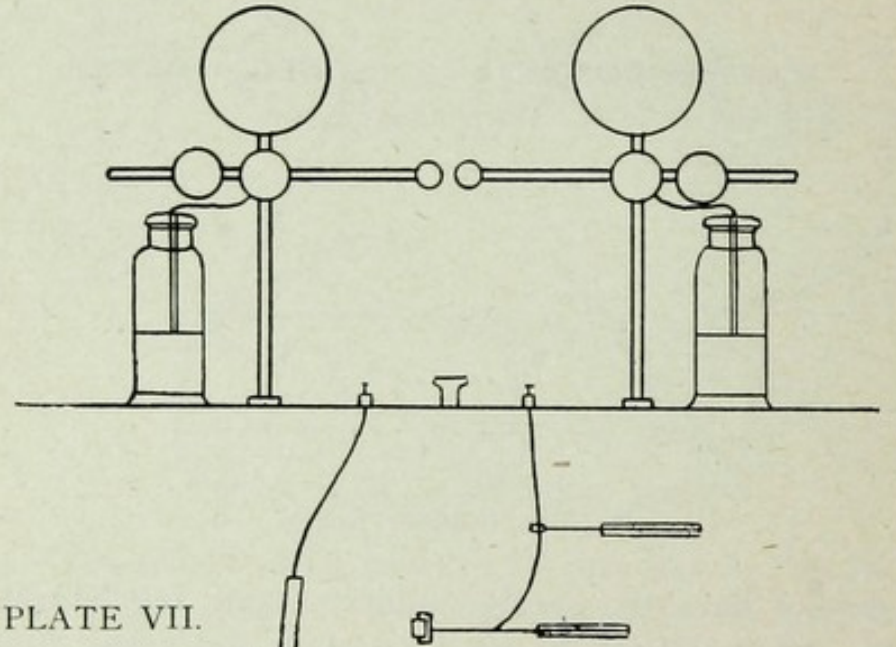


PLATE VII.

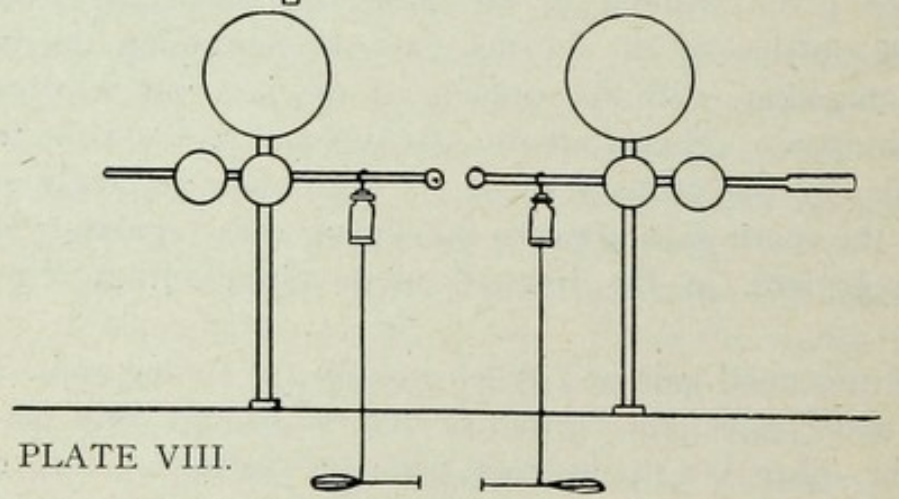


PLATE VIII.

Plates VII and VIII show connections made for Leyden jar mode.

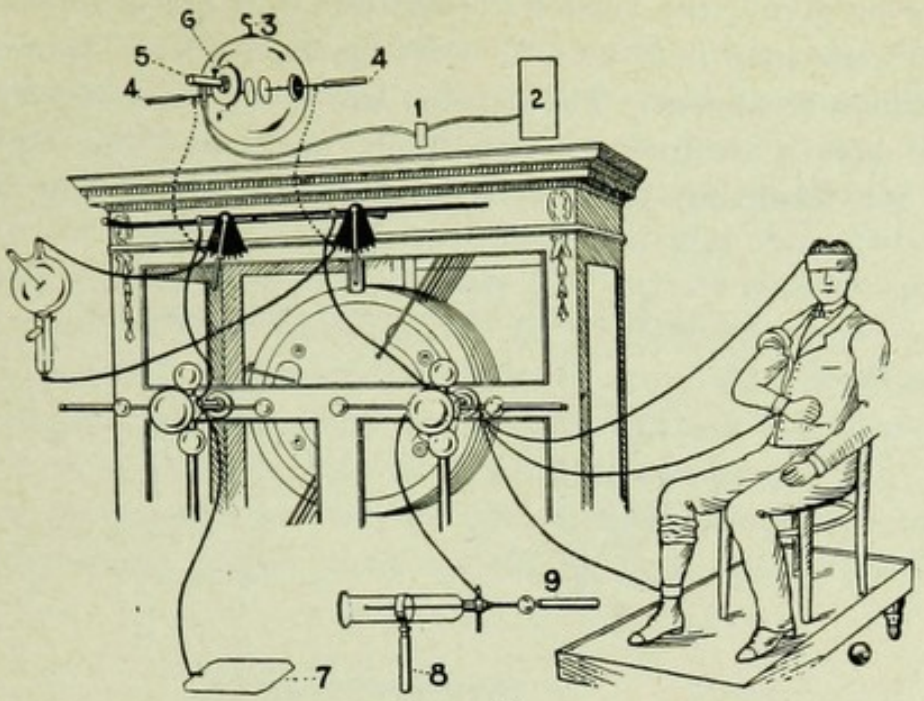


Figure 8.

Figure 8 shows how to attach the X-ray tube, the ozone outfit, the electrophoric outfit and the Morton wave. Only one outfit of the above can be attached and used at a time.

ELECTROPHORIC OUTFIT

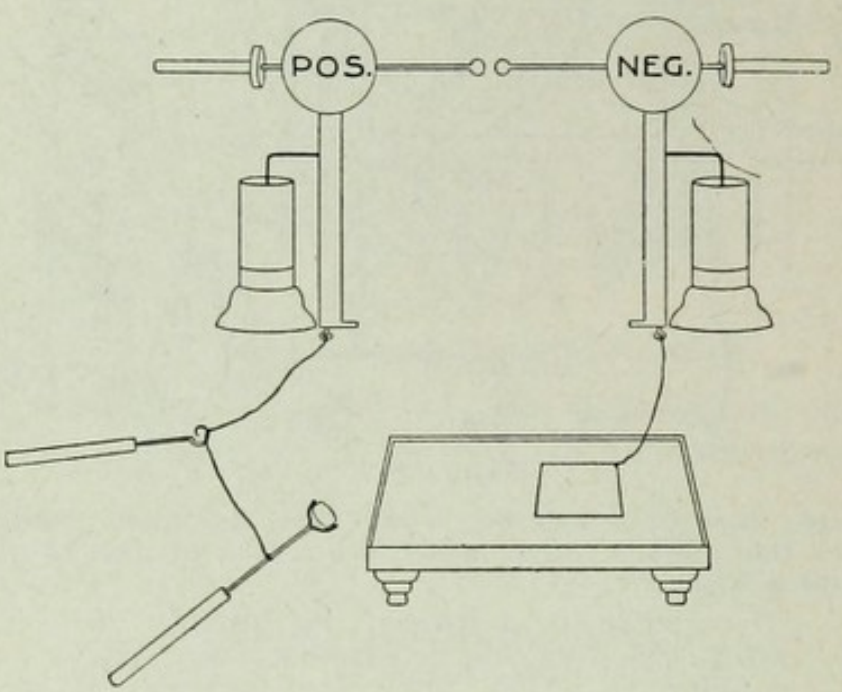
(See Figure 8).

Connect the positive pole of the machine to the binding post on the electrode 9, Fig. 8, and the negative pole of the machine should be connected to the patient or to the platform. A rubber tube should connect the electrode to your nebulizer or container under which an alcohol lamp may be placed. The electrification drives the medicated vapor to the patient by placing the open end of glass on the bare skin.

Morton wave is given with the machine, connected the same as giving friction spark. Instead of an electrode being applied through the clothing, it is applied to the bare skin. Electrodes made from block tin give the best results as they may be made in any shape and bent to fit any part of the body. The block tin should be from 1/16 to 1/8 inches thick. The length of spark should be from ½ to 4 inches or as much as the patient can stand. The speed of the machine should be governed so as to get from 1 to 4 sparks a second.

General Instructions Concerning the Electrodes—The hook and ring is for handling the chains, or connecting overhead crown, in order to avoid shocks to the operator. The long rod with the crook is to connect the machine to the platform. The silk covered cords are to be used with the induced mode. The short chains are to connect the induced mode device to the static machine. The long chains are for grounding

the machine or giving the various treatments with the different electrodes. The one with the snap is to be used with the electrode. The wooden point gives the mildest treatment. The wooden ball next. The wooden electrodes are for the breeze treatment. The single metal and the multiple metal points are for localizing the breeze, and are stronger than the wooden

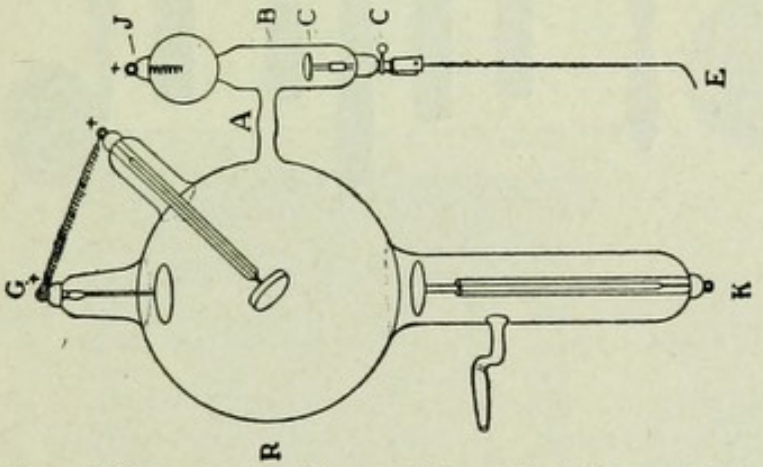


Massage Roller, with Induced Mode.

ones. The carbon point gives the mildest direct spark and the stronger local breeze. The small metal ball is for giving mild sparks, the large metal ball for giving more severe sparks, either metal ball to be used either direct or indirect. The roller is for giving general massage with short sparks either direct or indirect. The felt-covered disc rubefacient is for giving severe localized applications, either direct or indirect, with induced mode, and is to be held in contact with either the clothing or skin of the patient, where the effect desired is to be produced. The sponge covered disc electrodes are to be used with induced mode device. The spark gaps should be attached to the sliding rods, separated beyond sparking distance, with the small ball close to the ball of the sliding rod, and are of use in X-ray work.

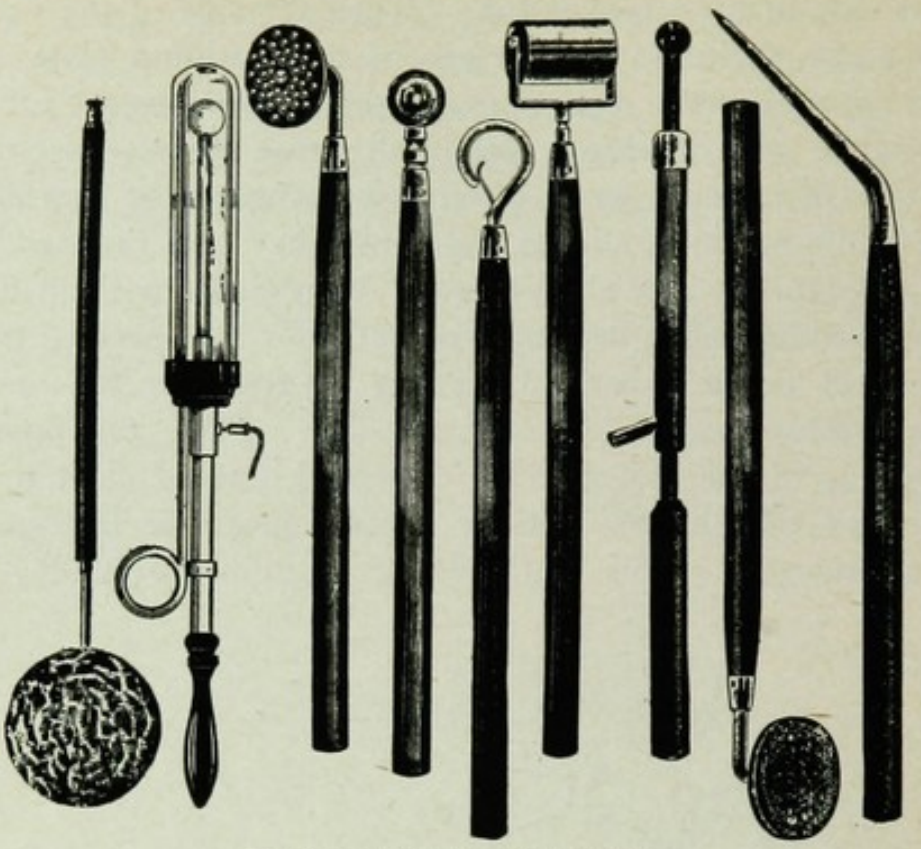
Fluoroscopic Examinations—Remove concentrator from standard. Place wooden tube holder in standard instead of the concentrator. Fasten the Crookes tube in the cork jaws of the tube holder. Attach the spark gaps to the sliding rods of the static machine, with the sliding rods widely separated, by means of the long green silk cords with snaps and hooks; connect the negative pole of the static machine to the ring nearest to the alumi-

num concave disc in the Crookes tube. Turn the side of the Crookes tube, which is at right angles to the surface of the platinum plate, toward the front. Start the machine in motion, and if the connections are properly made the Crookes tube will develop a yellowish green fluorescence, which will indicate that the X-rays are being generated. Lengthen or shorten the spark gaps on the static machine, sliding rods until they give the steady, continuous white spark and the tube shows steady fluorescence without flickering or spots. If the platinum plate becomes red hot, slow the speed of the machine. Place the object to be examined directly in front of the most brilliant field of the fluorescence as close as possible. Place the fluoroscope on the opposite side of the object to be examined, and as close to the object as possible, and the shadow will be shown upon the fluorescent screen inside the fluoroscope. This work should be done preferably in a dark room.



Regulating Tube for Radiographic and Fluoroscopic Work.

RADIOGRAPHIC WORK—Turn the tube holder and tube so that the most brilliant field of fluorescence points downward, and directly above the object to be radiographed. Short circuit the prime conductors of the static machine. This will darken the Crookes tube. Place the photographic plate which has been previously wrapped in black and yellow paper, with the film side upward, upon the table directly beneath the Crookes tube. Place the object to be radiographed upon the photographic plate as close to it as possible. Remove the short circuit from the prime conductors of your static machine, then the tube will again fluoresce, and the shadow of the object to be examined will be impressed upon the photographic plate. If the object to be radiographed is thin, it may be placed within six or eight inches of the tube, and short exposure made, varying from one to six minutes. If the object to be radiographed is thicker, the exposure should be longer, and the distance between the object and the Crookes tube greater, in order to avoid a burn.



Various Static Electrodes.

The above cut shows a variety of static applicators, for giving static treatments. They accompany every machine, and they will be found adapted for giving different treatments, and their uses will be advised in the therapeutic pages, and the needs of the operator will adapt them to his cases, as he meets them.

General Instructions—Should the Crookes tube not fluoresce it indicates that the tube is either punctured, or the vacuum is too high, or the mode running backwards. If the vacuum is too high, it may be lowered by gently rubbing the tube with a silk handkerchief, or gently warming it by means of an alcohol lamp. Should the tube be punctured, there will be purple light inside the tube, and no fluorescence on the surface. If the vacuum is too low, it can be raised by running the mode through the tube backwards. X-ray work should be done in a perfectly dark room, and preferably at night. Keep the photographic wrapped plate in a cool, dry, dark place beyond the reach of the X-rays when not in use.

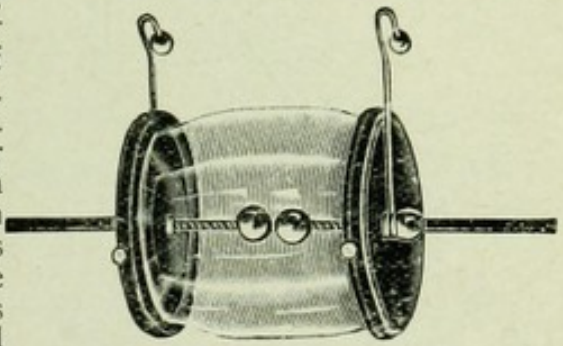
A special automatic vacuum regulating tube is a great advantage where prolonged X-ray therapeutic treatments are to be given. A multiple spark gap device also increases the efficiency of the tube, and a pole changing device avoids much annoyance and delay, but neither of these last appliances are absolutely essential.

These directions are general and apply to all makes of machines and are only intended as a guide to the beginner. Experience and practice

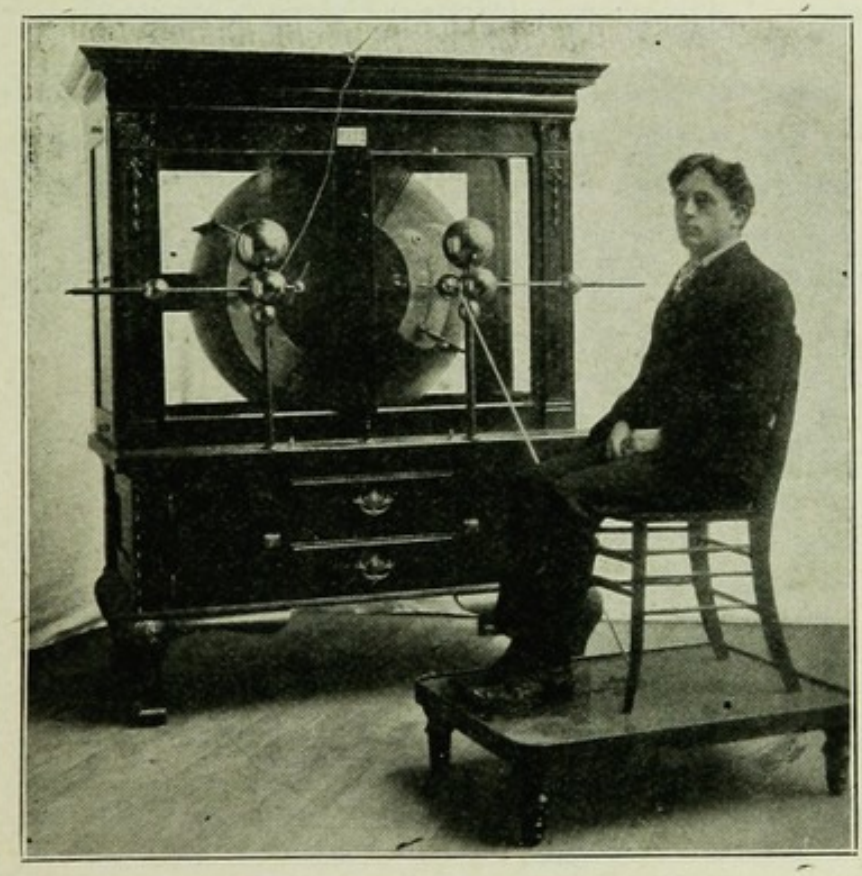
from repeated experiments will elaborate much of this technique, so that the operator can do the best work with the least trouble and loss of time or money.

SPARK MUFFLER

To use the spark regulator suspend it by hooks on the sliding rods. Have the sliding rods separated and sliding rods of spark muffler close together. Then separate sliding rods of spark muffler as you want to increase the mode. This device is to deaden the noise of the spark. If the mode does not pass through the cylinder properly, take the spark muffler apart and clean the glass cylinder and all parts carefully then put the cylinder in a warm oven a few minutes to dry the glass thoroughly and also to dry the air inside of cylinder so the mode will pass through the regulator properly when assembled again.



GROUNDING THE STATIC MACHINE



This shows the static machine with wire attached to upper part of case which can easily be transferred to opposite pole when wanted. From this point the charge is led to the ground by means of a gas pipe or wire and can return by another pipe or wire which must be entirely separate from the gas pipe or first wire, then with a metal chain connect to the electrode which you use. If a machine is grounded it cannot be over charged and a patient will be treated with a more uniform dosage. When giving a treatment with heavy modes or doing X-ray work, connect direct to the machine and do not ground it.

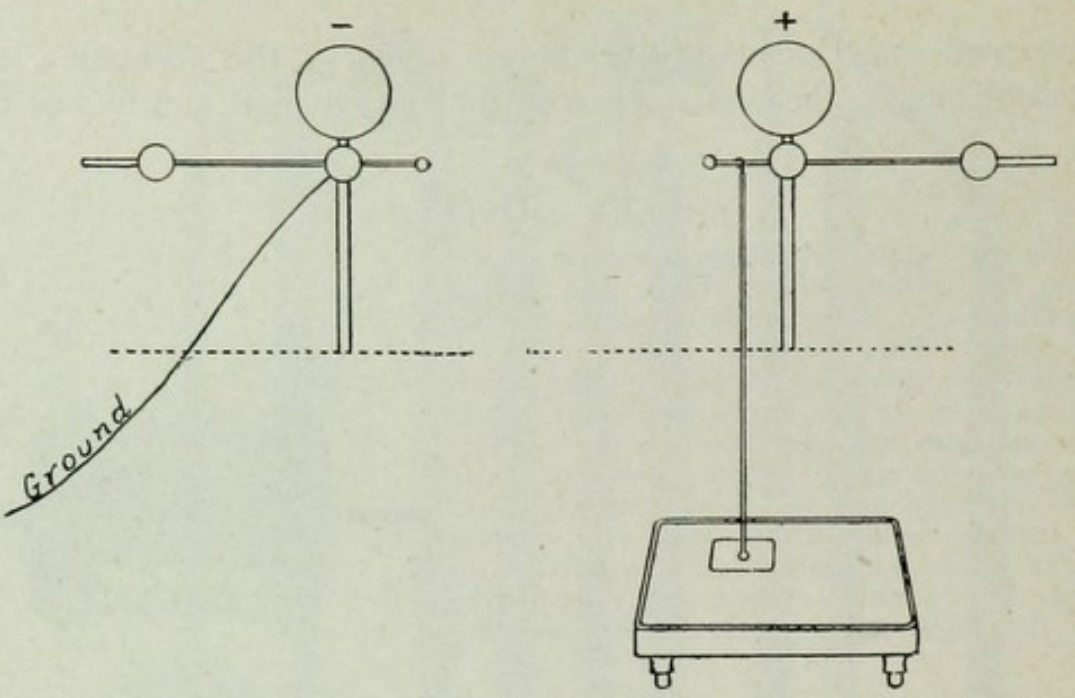


Plate I.

HOW TO REPLACE PLATES

A set of plates consists of 4 plates. The 1st and 4th are revolving and the 2d and 3d are stationary. The concavity of all plates is towards the back of the machine. The first and last plate in all machines has 6 metal buttons. All the other revolving plates are plain. The second plate in each set of four plates has 2 large pieces of paper, over 2 small strips of tin

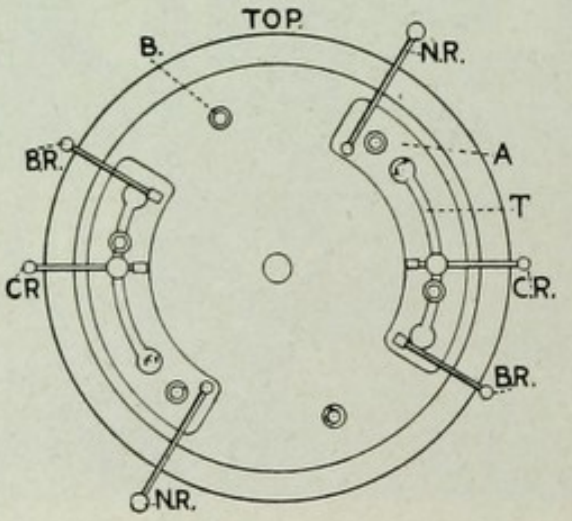


Figure 4.

foil on the back side of the plate and on the front side are 2 combs. The 3d plate in each set of 4 plates has 2 combs only on back side of plate.

When ordering repairs always state diameter of plate and diameter of shaft and also give the number on the back of case.

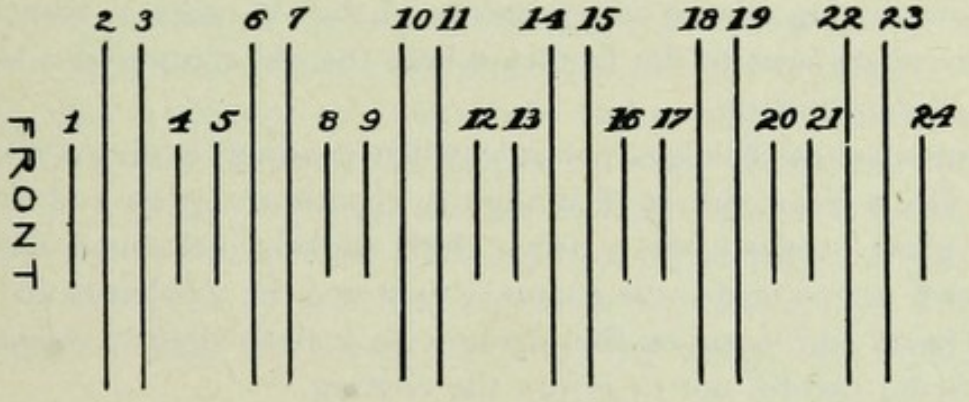
When the plates are removed from the boxes, stand them on edge, but place them in different groups. Do not allow moisture of any kind to come in contact with the coating on the plates. If the air is damp the plates should be placed where it is perfectly dry and where they would be protected from moisture in the air. It is often convenient to stand plates on edge between the stove and wall where the heat will keep the plates dry.

HOW TO ARRANGE THE PLATES

Plate No. 1, Set 1, this side faces front. Front revolving plate; plate No. 2, set 1, this side faces front, front stationary plate; plate No. 3, set 1, this side faces rear. Rear stationary plate; plate No. 4, set 1, this side faces rear, rear revolving plate.

The above represents the numbers as they are pasted on the plates before taken apart in factory. Care should be taken to replace them in the same manner. The numbers read from the front to the rear as shown below.

If any plates are needed, order them by number only, counting from the front as shown below. Also give size, etc. as explained above.



IF THE STATIC MACHINE FAILS TO GENERATE, READ THE FOLLOWING SUGGESTIONS CAREFULLY

Be sure the machine is thoroughly clean inside and outside. See that everything is properly adjusted so that the brushes touch the metal buttons well. Be sure the case is air tight.

When the air is cold and dry, as in the winter time, there is but little resistance in the atmosphere, and if your machine should generate faster than the mode is used it will spark across, following the path of least resistance. If the machine for above reason should spark on the inside move the neutralizing combs down near the collecting combs and run the machine

slower. If your machine does not generate properly after it is assembled dry it out thoroughly as it may have absorbed some moisture in transit. If it has been working properly, but stops generating, dry out the atmosphere on the inside of the machine carefully with calcium chloride.

Moisture and dirt on the outside are just as injurious as on the inside. Your machine should be cleaned daily on the outside and when the air is perfectly dry it should be opened up after each day's work to let the foul air out and the fresh air in. A machine, to give the best of service, must have good air just as much as a person.

The machine should stand about two feet from the wall, so one can pass all around it and wipe it off dry and clean every morning. It is a good plan to take a piece of cheese cloth and run over the electrodes and fixtures in front before each seance.

The case should be made as nearly air tight as possible by puttying up all openings and then shellacing over the putty. Use strips of felt under the doors. Once a year your machine should be taken apart and thoroughly cleaned to get the best results. If the coating on the glass plates does not show perfect insulation the plates should be recoated. The necessary material for this work would cost $3. If the old coating is in bad condition so that the new coating cannot be put on top of the old coating, then it is better to have the plates sent to the factory where the old coating can be removed and new coating put on.

If your machine changes polarity, when running, it means that it needs cleaning. Use a clean, dry woolen cloth to cleanse the glass. If this will not clean the glass properly, first, use a cloth slightly moistened with alcohol, being careful not to injure the coating; then use the woolen cloth. Clean all the metal parts and wood on the inside with a cloth slightly moistened with gasoline, being careful not to injure the coating.

If the brass fixtures are tarnished and if they cannot be cleaned as above directed, they should be removed and put in strong soap suds and heated to the boiling point, so that the lacquer will soften and scale off. Add lye to the solution to hasten the process. When the old lacquer coating is softened remove the parts from the water and clean them with a dry cloth quickly, while they are hot, then brighten them with common whiting and recoat with lacquer.

From June to September the machine must be kept in first-class condition or it will not work properly. Remember, every static machine will work if the plates are clean, the brushes in good condition and the air on the inside of the case dry. The ozone will cause a coating to form over the plates, and for this reason your machine must have special care.

It is a good plan to use precaution to prevent the machine discharging.

especially in warm, moist weather; after using the machine remove all portable attachments, as connecting rods and grounding chains. A piece of plate glass put under each leg will improve the insulation and help to prevent the machine discharging.

HOW TO RECOAT THE PLATES

Read carefully; you will see it is very simple and after it is done your machine will be just as good for work as it was the day it left the factory.

When taking the machine apart use every precaution to lay every part out in order as you take it apart so that when you are ready to put it together again you will know where each piece belongs. Remove all the combs and fixtures. Loosen the fiber nuts on the supports to stationary plates at the bottom and top. All at the support can be loosened and turned to one side on the small screw that holds it. Follow carefully the direction to assemble the machine and there will be no difficulty in knowing in what order the different parts should be loosened and removed.

If there is any difficulty in getting the plates loosened from the metal hubs, use a liberal amount of alcohol or chloroform if your machine has rubber washers, to loosen them. Some operators prefer to take a thin piece of steel with a sharp hook on the end so that the soft rubber washer can be cut just the same as a rubber is cut out under the lid of a fruit jar.

Simply place a piece of asbestos 33x33 inches on the top of an ordinary cook stove, then take three small blocks of wood about one inch square and half an inch thick. Drive a shingle nail through each block, then set the blocks on top of the asbestos with heads of nails down and put the plate on the end of the nails. The blocks should be set so that they will be equal distances apart. This will keep the plates up about one inch from the asbestos.

To recoat the plates, take the machine apart and place the plates on a table. Clean them thoroughly with a cloth slightly dampened with alcohol. If the coating is firm and hard and has not been damaged by using alcohol on the coating, then the coating can be applied on top of the old coating, but if the old coating is inclined to be soft and sticks or if alcohol used has eaten through the coating to the glass so that the insulation has been injured, then the plates need to be sent to the factory where the old coating can be removed and the plate properly dried and new coating applied. All moisture must be driven out of the glass before new coating can be applied. It is very important that the glass be absolutely free from moisture before applying any coating material.

To warm and dry the plates thoroughly before applying the coating ma-

terial, hold one plate at a time over a gas or gasoline stove moving the glass back and forth so it will heat gradually until it is thoroughly warm and absolutely dry and no moisture in the glass. Take a little less than half a pint of the coating material and add an equal amount of alcohol. Run over both surfaces of the plate with this coating. Then heat it again and as soon as the glass is as hot as you can bear your hand on it and is perfectly dry and free from moisture, follow with a heavy coat of the material furnished, without any alcohol whatever added to the material. The work should be done in a room where no drafts of air will strike the plates while you are recoating them. Move the brush from the center of the plate to the outside. Then turn the plate over and coat the other side. Reverse again until you have applied the thin coat and the heavy coat on each side. When it gets dry it should be transparent. If the plates are cloudy and milky in appearance, it indicates that the moisture is affecting the coating material and must be dried out at once. Apply the coating over the old coating and tin foil and metal pieces on the plates but not on the buttons on front and rear plates.

In handling the plates be careful to touch the edge only. The hands should never touch the flat surface.

It is sometimes very convenient to stand the plates on edge between a radiator or stove and the wall, to warm and dry them.

As full directions for taking the plates out of the static machine should come with it, you will have no trouble fixing up your machine so it will last forever and always do the same work it did when you first received it.

WHAT IS THE BEST COATING SOLUTION?

Dissolve orange shellac in enough ethyl (grain) alcohol. Do the same with gum copal in amyl (potato) alcohol. After the gums are all dissolved, mix the solutions in equal parts, and color with enough methyl violet to make any shade desired. Then follow the preceding directions for coating on hot glass plates. Apply three coats over new glass, or two coats over old coated glass. Allow plenty of time to dry between coats. This is the secret of a certain well known coating, and is the best.

HOW TO REPAIR A CRACKED PLATE

If a plate should crack, it may be repaired temporarily by sticking a piece of silk about 4 inches wide on each side of the plate over the crack with shellac. Then put a coating of shellac on top of the silk to insulate it. If a stationary plate should crack, change the position of the plate

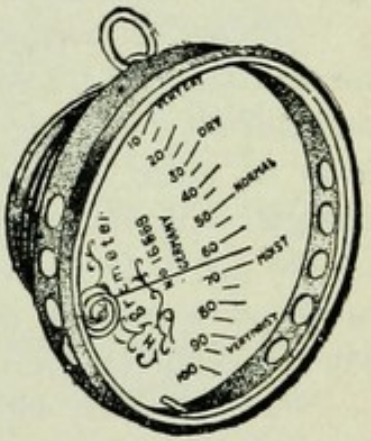
so that the crack is perpendicular to the neutralizing combs, for when in this position a crack would be in the neutral field and would not interfere with the machine generating properly. If the position of the plate is changed, then you should also change the tin foil, paper and metal combs so they would be in the right position after the plate has been changed.

The metal hubs of regular machines are all the same size. If you should have a machine where part of the hubs are short and part are long remember that the stationary plates fit over the short hubs and the long hubs go between the revolving plates which gives more space for the combs and the wide combs are used so that they come as near as possible to the revolving plates.

In some styles of machines there are 2 wires underneath at the right hand end that should be fastened together so that they make good contact when the machine is assembled. There are also 2 wires underneath at the left hand end which should be fastened together in the same manner so that the metal bases of the Leyden jars are connected together by these wires when the short circuiting switch is closed.

Be sure that the plates of the machine are revolved in the opposite direction to the movement of the hands of the clock and run up the speed to 300 revolutions per minute if the machine does not charge when it is assembled. If the machine has absorbed any moisture in transit, dry it out.

HYGROMETER



For measuring moisture of the atmosphere every owner of a static machine should have a hygrometer which should be hung on the inside of the case to indicate the moisture of the atmosphere. Should you have a hygrometer on the outside of the case or in the room and it registers 30 or more, you are near the danger point.

The best dryer for general use is 10 lbs. of pure fused calcium chloride placed in glass trays inside the static machine, so that all the surface possible of the calcium chloride is exposed to the air.

A good plan is to spread 2 or 3 pounds of calcium chloride in a glass tray spread out with as much surface exposed as possible, when the calcium chloride has absorbed moisture until it appears wet on top, then remove the tray with contents and put in its place another tray of fresh dry calcium chloride and continue according to this plan until the air inside of case is thoroughly dried out.

Before placing calcium chloride in the machine, it should be baked in an ordinary cooking oven until it is thoroughly dry and takes on the appearance similar to common salt. It will first appear wetter, and as you continue baking it, it will then become dry, and when it is thoroughly dry it will form in a solid mass, take a hammer and break it up. Then place it in trays in the machine and close the case up tight.

This plan removes moisture from the machine. Repeat the process of baking the calcium chloride if necessary, until the hygrometer registers about 20. Always remove the calcium chloride from the machine when it has absorbed moisture and has become wet in appearance and bake until it becomes thoroughly dry.

It is a good plan to have a second lot prepared while using the first lot and put it in a good receptacle and seal it up tight so it will be ready for use when needed.

There is a difference between fused chloride of calcium and chloride of lime, the latter being chlorinated lime which is used as an agent for bleaching straw, paper and cloth, and gives off fumes of chlorine gas. Therefore do not make the mistake of trying to dry your machine with chloride of lime instead of the fused chloride of calcium, for if you do, the chlorine gas will be set free and it will spoil the brushes and unite with the ozone and form a coating over the entire inside of your machine and prevent it from working. If you use calcium chloride that is not dry it will do no good, but give off chlorine and do harm. In such a case you would be compelled to clean it thoroughly before you could expect the machine to work.

In case of emergency, dry out the inside of the static machine with commercial sulphuric acid. Put one gallon in open vessels filled only half full and put on the inside of case. It is a good dryer but not recommended to keep in static machines continually. If your atmosphere is only slightly charged with moisture, put a quantity of chipped ice and a liberal supply of coarse salt in fruit jars that you can close up tight. The moisture will settle on the jars and run down into a pan under the jars which can be removed after an hour or so.

Another plan which may be tried in an emergency, is to put one half peck of the common unslaked carbonate of lime into a sack of coarse cheesecloth, then put this into another sack of the same material and lay this on a newspaper in the bottom of the case. By using two sacks in this manner, one inside the other, no dust will pass through the cloth from the lime, which should be removed when the case is dried out. This plan gives good results and has the advantage of being cheap and always available for temporary use.

STATIC VIBRATION

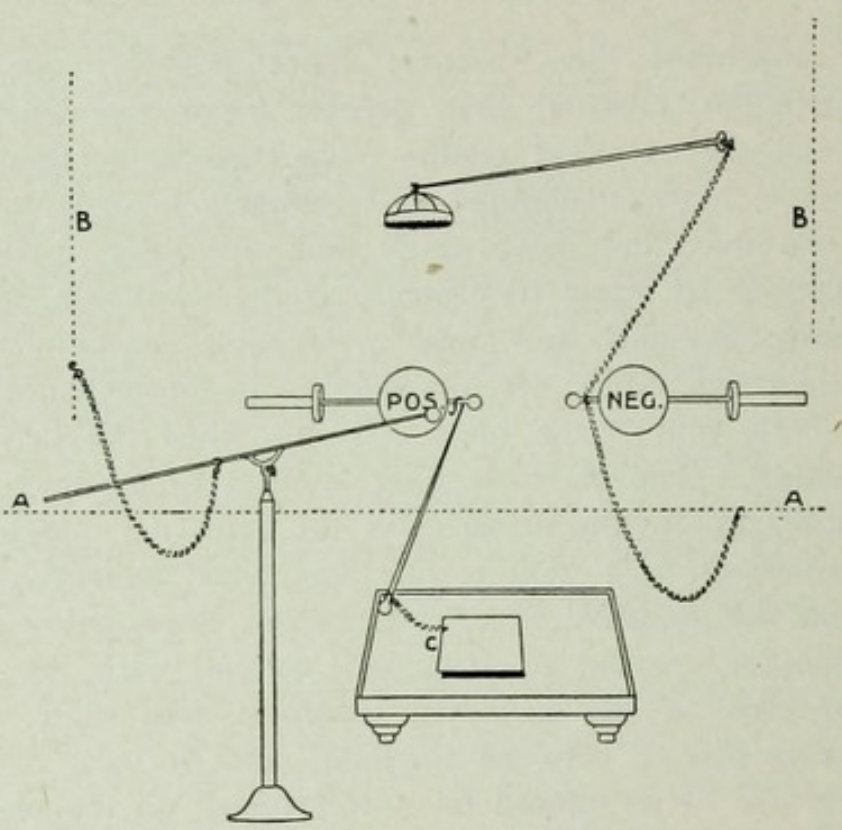
TECHNIQUE OF AN IMPROVED METHOD OF APPLICATION

Since static machines have become more popular, on account of improved construction, reduced cost, greater knowledge of the laws of electrification, and the excellent results from treatments, there have been many developments in the technique of treatments in order to render the remedy more effective, and more easily and pleasantly applied. Of the various modifications of static treatments, as the insulation, breeze, direct and indirect sparks, induced, and surging, probably the latter has received less attention than any, since its introduction by Monell, but this mode is probably the one that is the most effective when the details of technique are mastered. The static surging is used to produce a wave-like surge or vibration among the tissue cells. It gives the muscles work and stimulates contractions in a mild form. The usual method is to use the ball electrode on the standard as an interrupter, by drawing sparks from the prime conductor, instead of from the patient, with the same prime conductor connected to the insulated platform foot plate, over which a pad of paper is placed, between the plate and the feet of the patient, or the bare feet are better placed on a wet towel, on the plate, to avoid irritation. The opposite prime conductor is connected to the overhead crown, or grounded, or both, according to the effect desired. This technique is illustrated in Fig. 1.

Another simpler, and therefore better way, is to omit the standard and ball rod. Ground the negative side of the machine, or, better still, attach it to the overhead crown (same as in Fig. 1), placed two or three feet above the patient's head, on platform. Then attach the positive side of the machine to the bare skin of the patient, with a wet sponge electrode placed directly over the part most affected. Bring the sliding rods of the pime conductors together (instead of being separated as in Fig. 1). Start the machine and gradually separate the sliding rods, as in the static inducted treatment. There is a still better modification which

has been used for a long time by the writer, with very satisfactory results. The apparatus is simple and not costly, and it should be an attachment of every static machine. It is easily adjusted to those machines having two adjustable spark gap posts, such as are used in X-ray work.

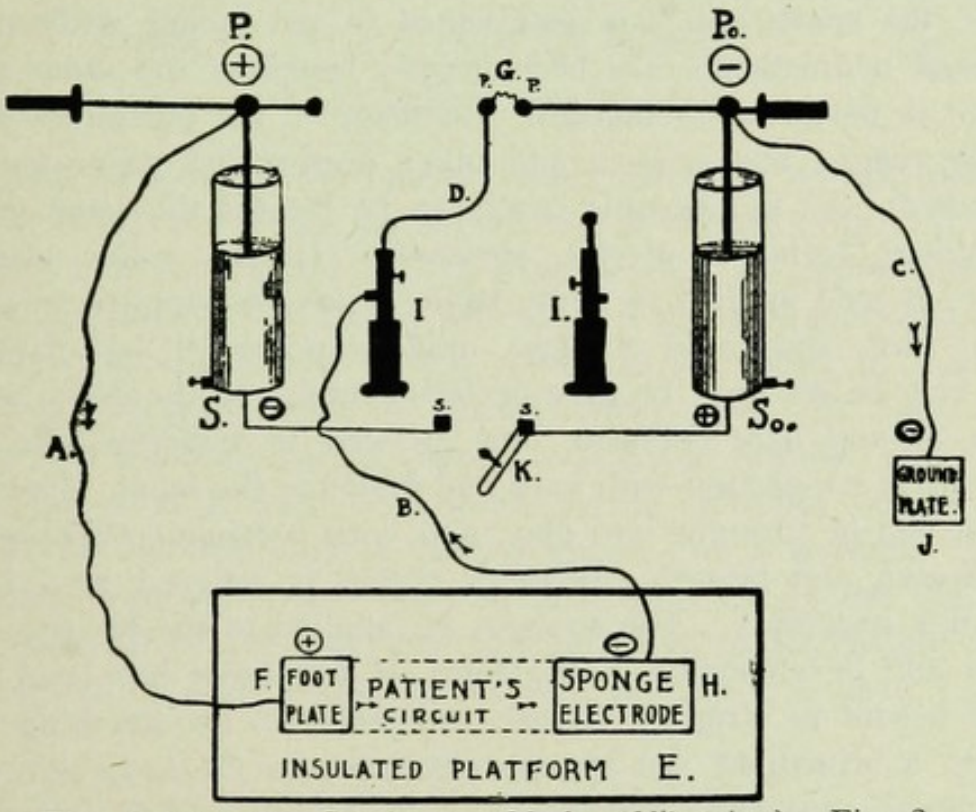
It is shown in place in Fig. 2, and consists of a curved rod D, made so as to fit into either rubber post I, and held rigidly by a thumb-screw, so that the ball on the top is in the center, between the sliding rods P and Po. It can be used on either side. Experiment has shown that the positive point of entrance to the patient has a sedative, soothing effect, while the negative point of exit has a stimulant irritant effect. In



Potential Variation, or Surging. Fig. 1.

this respect it closely resembles galvanism, and those who are in doubt as to static polar effects may note a difference in the static vibration, although it has not been the experience of the writer to note any marked polar difference in the other modifications of static electrification, but to be safe he follows the usual rule of polar modalities. The technique of the writer's improved mode of vibration treatment is shown in Fig. 2. If you have one part where you wish sedation, and another where you desire stimulation, you can get both at once, or by placing one electrode on some indifferent part, you can get either effect desired, at any other part, by arranging the connections as shown in Fig. 2, or the exact reverse. For instance, if you wish to stimulate the spine or kidneys: Pull

out the positive sliding rod P. Attach same by cord A, to foot plate F (indifferent). Attach wet sponge pad electrode H to back on bare skin. Connect by cord B to the insulated terminal D, close spark gap at G by pushing in the sliding rod Po, which is connected by C to ground plate J. The Leyden jars, one or both, may be either off or on. The effect is more pronounced if both jars are on, and still more marked if the outer covers of the jars are connected, by closing the secondary induced mode from S to So, by means of the switch K. The effect can also be modified by taking out the ground circuit C, and completing the circuit through the machine. The size of the jars, and the size, number and speed of the plates all change the effect, but the length of the spark at G regulates the force of the wave surge, or vibration.



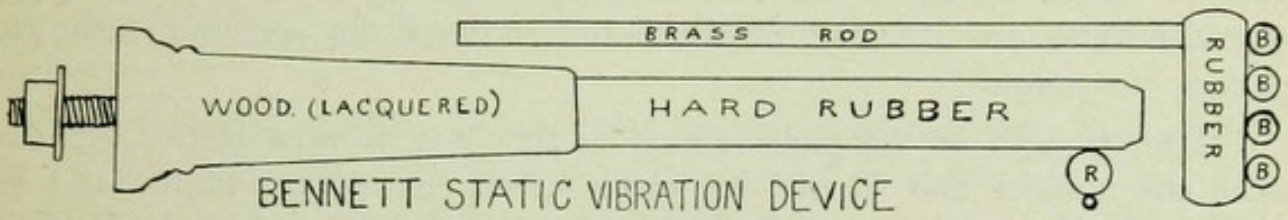
The Interrupted Continuous Mode (Vibration). Fig. 2.

When the gap at G is closed there is a constant flow of static electrification from P, through A to F, through patient to H, through B to D, to Po, through C to J, and with patient on platform E, he has a static flowing bath, without sensation. The entrance then is positive at F, and exit is negative at H. Simply opening the gap at G backs up the positive mode, and puts the patient in a state of stress, which increases like a rising wave until the potential pressure or strain is sufficient to overcome the resistance of the transparent, elastic, dielectric air spaces at the gap G; then there is a spark there, which relieves the stress, and there is a consequent reac-

tionary subsidence of the wave, in the patient's circuit, which again rises and falls with successive surgings, regulated to a nicety by the spark gap G. This effect can be made in the ordinary insulation, by drawing direct or indirect sparks from the part to be treated, but it is very painful, and a succession of such sparks will blister. The above technique transfers the spark from the sensitive skin to the metal terminal D, so that the effect can be kept up a long time, not only without pain, but pleasantly, and with relief of pain. The writer has used the vibration by applying the sedative positive sponge, electrode F, to a very painful skin, in gonorrhœal rheumatism, with the effect of completely relieving the pain, and taking the swelling from feet that had not had on shoes for weeks, so that he could wear shoes in three days, and walk without canes. At first a spark gap of half inch was severe, but in a week, with half-hour daily treatments, the spark gap was lengthened to ten inches without discomfort. Sexual neurasthenia has been greatly benefited the same way, with sponge pad to perineum to sacrum. Lumbago in the person of the writer yielded like magic, and sciatica and other deep-seated nerve troubles are easily handled. All gynecologic cases can be treated the same way, using a bare vaginal, rectal or uterine electrode. If the roller electrode is attached to B, and applied to body, labile, it may be applied to any or all muscles in turn, and rapid or slow, mild or powerful, but painless contractions, may be set up. To give perfect exercise to the arms, wind positive chain around bare forearm, and proceed to interrupt the mode or make a positive connection with bath and immerse the hand. Every muscle of the arm will be brought into play, and with continous exercise the arm becomes brown and tanned. Writer's cramp is relieved in a few treatments by this treatment. The sponges H, applied to the breasts, stimulate circulation and development. This form of treatment has been found of wonderful benefit in Bright's disease and diabetes, by attaching the positive pole to a bifurcated wet sponge electrode, to the bare skin, over the kidneys. Some apparently hopeless cases have been symptomatically cured, without drugs or diet, with this simple treatment. Cases of hysteria, neurasthenia, chorea, melancholia, hypochondriasis, and other allied neuroses, will receive greater and more prompt benefit from static electrification applied this way to the spine and genitals than perhaps any other form of treatment. Do not approach or touch the patient or machine with the spark gap open, or you will regret it. Simply closing the gap G renders everything safe to approach or handle on the negative side, and sliding the rod P until it touches D, makes the positive side safe to handle. After giving a vibration treatment as above, it is well to wind up with a

static insulation or bath, for a few minutes. To do this, simply pull out the sliding rod Po, quickly, beyond sparking distance; and it is done. Treatments should be given daily, for from ten to thirty minutes, and in severe cases, longer. While it is not known that this treatment produces any chemical effect in the tissues, it will by its catalytic action, increase the circulation, improve nutrition, assist digestion, and assimilation and quiet, refresh and invigorate the entire system, locally or generally.

AN IMPROVED DEVICE AND TECHNIQUE



Can be attached to any machine.

Inasmuch as some of the recently made machines do not have the old style double spark-gap posts, as shown in the sketch (Fig. 2), to which may be fitted the curved rod "D," I have devised an improvement in the way of a single post shown above, which has a multiple spark-gap arrangement. This is to be placed in the center of the base, in front of the machine, and the gaps may be turned either way. It may be easily attached to any machine, and is simple, strong and durable, and the added feature of the multiple gaps adds much to the efficiency of the vibration mode. All that is required is a rule, a gimlet and a wrench. The brass rod, telescopes into the rubber post, so that when not in use the gaps are dropped down out of the way, and can be raised to any height, and held by the set screw "R," to which the conducting cord is hooked.

STATIC INDUCED SOLENOID SHUNT MODES

The question has been asked as to the advisability of having a static machine or of having a large induction coil. If it is a choice between the two when you may have but one or the other, then by all means take the static machine (see page 233).

The coil alone is most excellent for prolonged and heavy X-ray work, and it is also useful for what is known as the high frequency mode. Both of the subjects will be taken up in detail later, and we only mention them here in this connection, in order to answer the question above.

Aside from these considerations, there is little or nothing to commend

the coil in therapeutic work. On the other hand the static machine will do all of the work of the coil, as the work of the general practician will need them, and in addition to this, the static machine has such a wide range of therapeutic usefulness, which the coil does not have, and is withal so easily regulated and controlled, that the balance is greatly in favor of the static machine, as against the coil. An oscillatory or vibratory mode effect may be derived from the static machine by means of a simple apparatus, in connection with the induced mode, from the outside of the Leyden jars. This apparatus consists of a solenoid, or coil of wire, the central part of which conducts the static induced mode in short circuit, while the electrodes are attached to the outer ends of the solenoid with the patient "in shunt."

The strength of the mode gotten in this way from a static, depends upon the number and size of the plates of the machine, and the size of jars used, while frequency depends upon the rapidity of the discharge between the prime conductors, which in turn depends upon the rapidity with which machine can be run.

Solenoids can be made in many shapes, according to tastes, and the space you have for them. The connections are made from the bottom of the Leyden jars, with the solenoid, so that the middle third of its wire is embraced by them, leaving the free ends of the solenoid wire to furnish the modes in question. From binding posts at each of these extremities is taken the mode, and carried by common flexible light wire to the patient. It is applied in a mono-polar or bi-polar manner. One end is attached to tin foil, wetted pad or other electrode and bound snugly to the opposite side of the part to be treated, or some indifferent point, and the other end is attached to a thick, very fine wire brush, and passed about the part to be treated, taking care not to approach too near, lest the patient receive a shock.

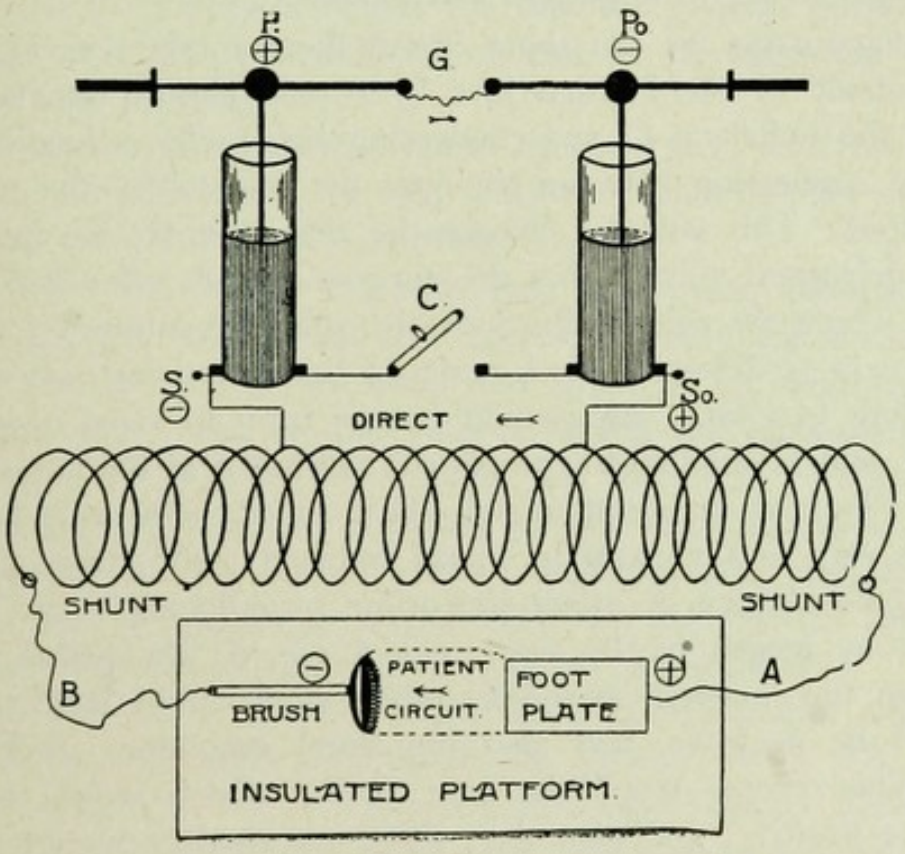
As a rule the brush should not be held nearer than 2 inches, nor more distant than 5 inches from the part, unless it is pressed firmly against the part treated, as we give galvanism. This mode can be derived from any static, but the wire used in making the solenoid must be diminished in length and size, according to the number and size of plates in the machine. The larger the Leyden jars used, the longer the effluvial discharge. The room must be darkened in order to see the discharge, which in a darkened room is seen to pour forth in millions of purple streams, all along the conducting wire as well as from the brush, where it throws forth one ray for each fine wire it contains, and the more it contains the better the effect. The Leyden jar mode can be introduced at other points in the solenoid

wire, than as shown in the diagram, and the high tension high frequency mode taken from most any point exterior to the introduction of the exciting one.

This mode is most excellent in the treatment of cancers, that are exposed, lupus, old sores and other such like superficial skin troubles, whether caused by certain bacteria or not.

A case of tibial ulcer was cured after only twenty consecutive daily applications of this treatment. When the treatment was begun, the ulcer was three inches in diameter, and had resisted all kinds of treatment from several other good physicians, for a period of three years. Other ulcers, skin cancers, and the lungs in consumption, are treated in about same manner.

The technique of the application is to place the negative, back of the part to be treated, and keep it concentrated on the fixed point for from five to fifteen minutes daily, unless it causes too much reaction. In the treatment of rheumatism or paralysis, the technique is about the same. In constipation, put one pole to the nates, or in the rectum, and pass the brush over the abdomen, following the course of the colon, from right to left. In goiter and enlarged prostate gland, apply the positive pole to the gland. Most excellent results have been obtained in these cases.



The above sketch shows the details of the construction, and the method of connection of this solenoid, so as to get this shunt mode, and

by referring to the sketch the following explantion will make the same clear, so that you can construct one, if desired, and get the same results.

This modification of the static mode is one of the best drawing cards in the whole electric line, being catchy, impressive, popular, and is painless, requires the removal of no clothing, and at the same time gets splendid results.

It acts on vaso-motor nerves, as is manifested by the patient's pespiring after a fifteen minute seance, and this without any suggestion whatever. This effect has been noted repeatedly, but is not always a constant result. One case who had not sweated for six months, began at the first sitting. In this case the negative electrode was applied to the bare skin over the abdomen, and the positive brush, directing effluvia, was held a few inches from the cervical and dorsal spine. This mode is also a sedative, relieving pain, which subsides as soon as they get warm, and the relief lasts for several hours.

The prime conductors will act as a rheostat to control the effect of the mode, by simply regulating the length of the spark gap. The sliding rods should be brought together whenever the electrodes are being placed or moved, so as to short-circuit the machine, and so avoid disagreeable shock to both the patient and operator.

In ordinary cases we can short circuit the secondary or induced mode from the outside of the Leyden jars by simply closing the switch at C. By opening the switch at C, and connecting jars to the solenoid we simply lengthen the connection between the jars by interposing the middle third of the solenoid. This will not change the character of the induced mode, as it is of such great voltage that the wire would not offer any appreciable resistance. Thus, the middle third of the solenoid connected to the jars, carries the main or direct induced mode, so that whatever part of the mode that, according to Ohm's law, would escape from the two outer thirds of the solenoid, and be applied to the patient as shown in the cut at A and B, would be an indirect or shunt mode. This shunt mode would be affected in the same way as the main or direct induced mode, from S to So, by whatever would change or affect the prime or inducing static mode from P to Po, or by length of the spark gap at G. If the prime mode P be positive, then the induced secondary mode at S would have the opposite polarity and be negative, and also the shunt secondary at B would be negative. The reverse would be true at Po, which would be negative. So would be positive, and also the shunt terminal A would be positive. This will settle the question of polarity as long as the prime poles P and Po are beyond sparking distance at the gap G, and with the switch open

at C. If you short-circuit the prime mode by closing the gap G, you get no induced mode at all, anywhere. If the prime rods, P and Po, are beyond sparking distance, then all parts on both sides are put under great stress. If you make a gap G, and a spark jumps, you get a surge through the whole secondary circuit, both direct and shunt. After the stress at the prime terminals is relieved by the spark at gap G, there is a reactionary wave restoring the stress, all through the circuit, which increases until the strain breaks down the resistance of the elastic air dielectric, at G, and another spark again relieves the stress. This is repeated, the rapidity being governed by the length of the gap at G. The shorter the gap the less the stress and the milder the surge or potential variation in the secondary circuit. This potential variation or surge, caused by the spark at G, will account for the glow in the vacuum tube, without reference to anode or cathode. While the polarity of this solenoid mode does not alternate as does the faradic or magnetic induced mode, it varies in potential and remains fixed. As there is no amperage to the static mode, either prime or secondary, there can be no magnetic induction.

Which static machine would you prefer and why?

The static machine which is the best for general purposes is the one which will give the most uniform output of electrification with the least annoyance and expense.

The static machine is a dynamo or generator, and the plates may be likened to the cells in a chemical battery. That is, the more the plates the greater the volume and potential.

However the static machine has one great difference, viz: the enormously high voltage and the correspondingly infinitesimal amperage. The one too great, and the other too small to be measured. There has been great stress laid on the rate at which the plates are revolved, as having much to do with the voltage, but when the voltage is so high as to be beyond measurement, probably up into the millions of millions, what difference does a few millions, more or less, make, and how absurd the statement that a few plates turned very fast will deliver the same volume that a large number of plates turned slowly will deliver.

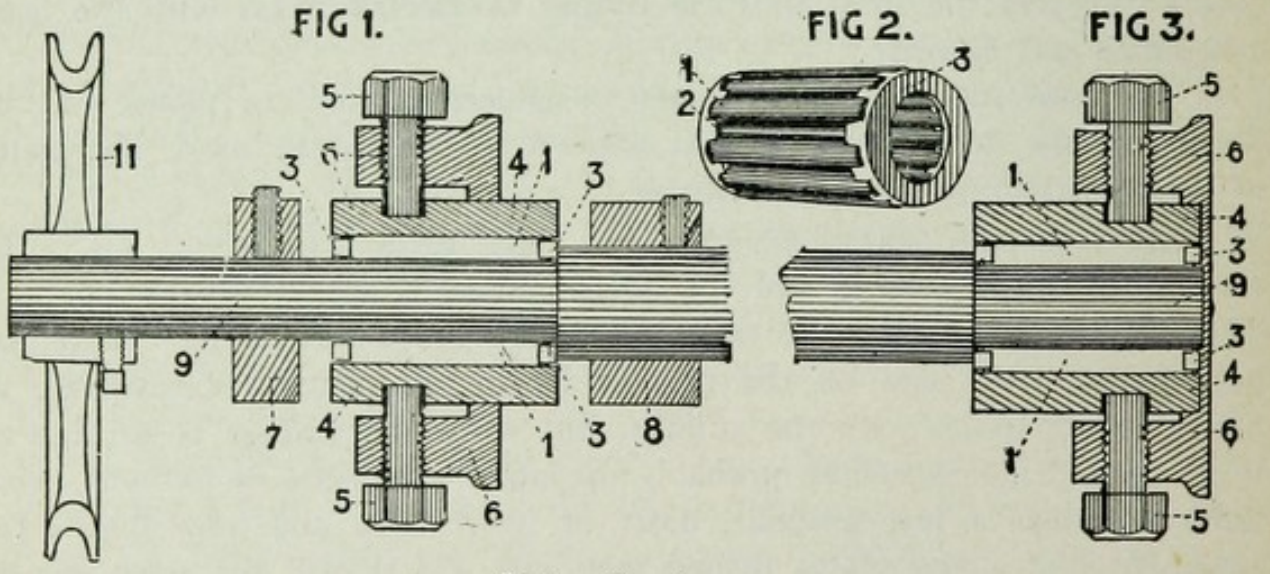
A feather and a cannon ball in a complete vacuum will fall with the same rapidity, but when they reach the bottom one is still a feather, and the other a cannon ball. They are not both cannon balls, and the one will break the bottom out of the tube, while the other will not. A little dog running beneath a carriage will have to move his feet very fast in

order to keep up with the horse, although the larger animal may be traveling at a moderate pace.

They both arrive at the journey's end at about the same time, and the canine may even outstrip the equine, but, when both stop, what a difference there is in avoirdupois.

Various materials have been experimented with in the construction of the static machine plates, and all have given more or less satisfaction and trouble, and none are perfect, but the concensus of opinion among investigators and physicists is in favor of glass for the plates, both stationary and revolving.

On account of the difficulty of rolling the glass thin, and at the same time having it cool without warping, some have tried the heavy plate glass, but these have been abandoned on account of the extreme weight. Therefore it is a drawback that the glass is seldom true, or balanced, and on account of the elasticity and small power of cohesion, the glass plate cannot be turned very fast with safety. However, this is not at all necessary, and the glass being cheap, we may add more plates, and with less expense for power turn more plates slowly, with better results. The different thicknesses of the various plates can be so evenly balanced on the axle or main shaft as to effectually minify or prevent vibration or pounding, which must follow the revolution of an eccentric weight.



Roller Bearings.

There is no material used in the construction of any static machine plate which is perfectly true, or which will remain so if it could be made so, on account of the effects of the physical conditions surrounding it, such as heat, cold, humidity, etc.

If any one should tell you that such or such a machine will generate

electrification all the time, and under all conditions, without any qualification, then beware. There is none that will do it.

They are selling machines; we are stating facts. Take your choice. There is no question whatever among machinists about the great advantage which the roller bearings have over the old style ball or spindle bearings, as the difference in the cost is more than made up in the lessened friction and strain, with the consequent decrease in expense of repairs and outlay for power. Get the best. (See page 226.)

On account of the ease of operation and generation, the type of machine known as the Tœpler, which is self-charging, is the more preferable. Therefore, after twenty years of study of the physics and mechanism, and experiments with nearly all the different makes and materials, and after noting and consulting with many disinterested students, experimenters and observers, I would advise the selection and purchase of a Tœpler type of self-charging machine, with all glass plates and roller bearings, set in a rigid frame case, as nearly air-tight as possible, as likely to prove most satisfactory and economical.

In which direction must the plates turn?

The plates of a static machine should revolve from right to left, at the top, or just the reverse of the direction in which the hands of a clock move. Many blunders have been made by beginners, on account of overlooking this simple rule.

How would you restore a lost charge?

If you should not have a self-charging machine, or if for any cause the machine will not generate, or has "lost its charge," there are various ways of charging it again.

Thoroughly clean and dry the machine, case and plates.

If the shellac coating of the plates is old and "dead," then remove it, and recoat the plates.

Connect the terminals of the machine in series circuit with another machine or a higher tension induction coil, which is generating, and transfer a charge to your plates. Hold a piece of fur, cotton or silk lightly against the front of rear plate, while the same is turning. Warm the plates slightly if they are chilled. Lift up the end of the case and jar it down slightly. Discharge a heavily charged condenser or Leyden jar charge upon the prime terminal of the machine. Run the plates backward for

a few minutes, and then reverse, and run forward as they should turn. Renew the brushes if dirty, greasy or worn.

Renew or thoroughly bake the dryer if it is wet. Set the machine in the bright sunlight for a few hours. Remove the machine to another room, or upstairs, or away from an open window, or brick wall, or from over a cellar.

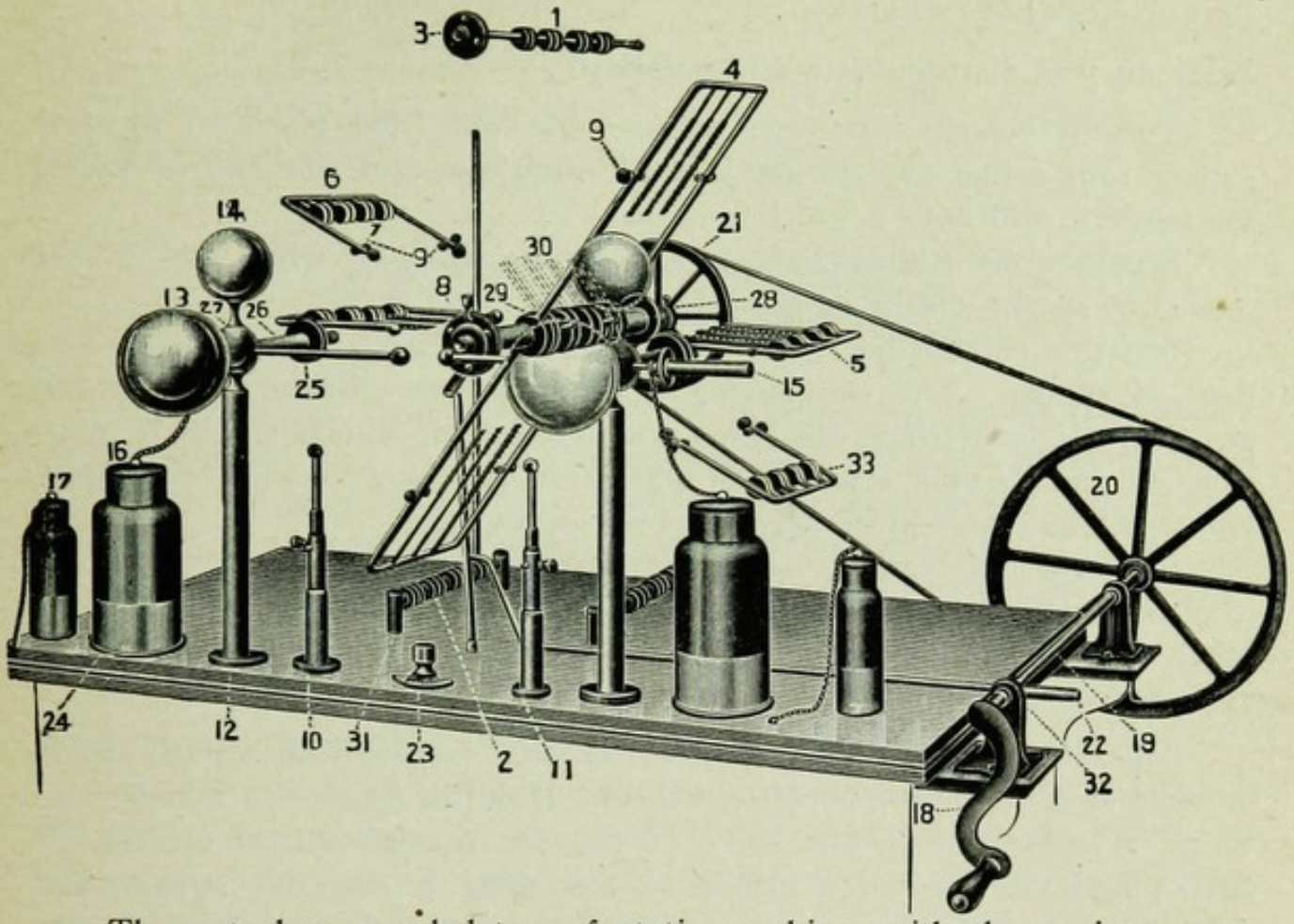
When no spark can be generated, if the wires are all in their places, then it is because the moisture has settled on the plates, and, if you readers or operators will rub your fingers on the revolving and the stationary plates, you will find a gummy substance adhering thereto; so long as that remains no spark can be generated. Another remedy for quick and permanent relief is as follows: Get about four ounces of benzine. A piece of muslin or coarse cheesecloth about 36 inches long and 5 or 6 inches wide. Saturate the cloth with the benzine, wring out about three-fourths, and then at full length hold the cloth between the plates, while another person slowly revolves them. Work between each plate in the same way, also rub on the back of the stationary plate; afterwards gently rub the iron and painted parts, also the inside of the machine, all over the woodwork. Then for one hour close up the case. Afterwards place in the machine the dry calcium chloride, and within fifteen minutes you may generate a spark of from nine to twelve inches. Occasionally bake the chloride, when the operator finds the spark does not immediately generate. Reversing the machine, say for five or ten minutes (run it backward and forward) will often start the mode flowing.

If you have a high frequency or X-ray coil in your office, as well as a static machine, and your static has lost its charge, you can transfer a charge from your coil to your machine in this manner.

Connect the large Leyden jars to your prime conductors, with the sliding rods about an inch apart. Start your machine at a moderate rate. Connect the negative pole of your X-ray or high frequency coil to the positive side of your machine, using one of your X-ray cords. Start your coil to operating. You will get a bluish stream of sparks across your prime gap on your static machine. Gradually pull out a sliding rod on the negative side of the static machine until you get an intermittent white spark, about two or three inches long. Then with your insulated static hook, disconnect cord from the static machine which conveys the charge from your coil, and stop your coil. By this time your static machine is probably working properly. If not, repeat the operation until it does.

Any one or more of these expedients will sometimes start the "juice" to running from an apparently dead machine.

What are the names of the parts of a static machine?



The cut shows a skeleton of static machine, with the various parts numbered so that by referring to the list of numbers and names, you can recognize each part by itself. Different machines will all vary in the details of construction, but the above are the main parts of the self-charging Tœpler static machine.

No. 1 Upper cross bar with washers.
No. 2 Lower cross bar with washers.
No. 3 Front support at upper cross bar.
No. 4 Upper arm equalizer and combs.
No. 5 Horizontal arm and combs with ears.
No. 6 Upper left side brush arm.
No. 7 Clamps holding arm to plate.
No. 8 Oil cup to front bearing.
No. 9 Exciter brushes.
No. 10 } X-ray posts for use when there is no multiple spark gap or pole-changer attachment.
No. 11 }
No. 12 Hard rubber main post.
No. 13 Large brass ball.
No. 14 Small brass ball.
No. 15 Sliding rods with rubber handles.
No. 16 Large Leyden jar.
No. 17 Small Leyden jar.
No. 18 Crank handle to hand shaft.
No. 19 Crank shaft.
No. 20 Crank shaft large pulley wheel.
No. 21 Rear axle pulley wheel.
No. 22 Rubber handle and mode controller (a nuisance).
No. 23 Rubber switch and mode indicator.
No. 24 Base of Leyden jar.
No. 25 Rubber washer on sleeve front glass.
No. 26 Sleeve of hard rubber, threaded for washer.
No. 27 Brass head to main posts.
No. 28 Oil cup to rear bearing.
No. 29 Front hub on main shaft.
No. 30 Glass plates, revolving and stationary.
No. 31 Lower support for stationary plates.
No. 32 Iron bracket for crank shaft.
No. 33 Lower right side brush arm.

THE POLARITY OF A STATIC MACHINE

How do you distinguish static polarity?

To test polarity of direct static mode, start the machine, separate sliding rods a half inch to get a steady purple stream, one end of which, the positive, will have a white spot.

Separate the sliding rods several inches, and the white end of the stream of sparks will be on the negative side.

Separate still further four or five inches, and get a steady, continuous flow of sparks. The end having a single stream dividing into several about a half inch from ball, like a tree trunk with branches, will be positive, and have a pink color. The other side, having a number of streams, like tree branches, will be negative with bluish color.

Separate still further, six to ten inches, to get the brush or fox tail discharge, like a paint brush, on one side, and a feather duster on the other. The brush side is negative and bluish; the duster side is positive and reddish.

Separate balls on sliding rods two or three inches, with several steady streams of sparks passing between them. Hold the head of a match close to, or in contact with, one ball. If you can concentrate the streams of sparks into the head of a match, so that there is only one stream, and coax it away from the center of the ball to one side and hold it there till the match burns, it will be the positive pole.

Separate sliding rods beyond sparking distance, and look through the machine from the end, so as to see between the plates, and on the negative side, the revolving plates will be covered with a violet sheet of light for several inches ahead of the collecting combs.

When the machine is in action, and the sliding rods separated beyond sparking distance, there will be a distinct hissing sound produced at the positive pole.

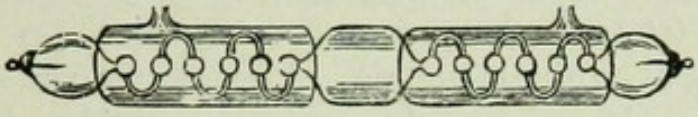
When some insulator or non-conductor, as a rod of hard rubber, glass or dry wood, is brought near to the prime poles, there will be a discharge of electrification to it, from the positive pole, and not from the negative.

With the machine in action, and the sliding rods beyond sparking distance, if a lighted candle or alcohol flame be placed between the poles the flame will be bent away from the negative and toward the positive pole.

When the overhead crown treatment is being given, the positive will relieve pain and congestion, while the negative will irritate and stimulate circulation.

When the X-ray tube is properly connected with a machine, one half of the tube, opposite the flat electrode, and on the side towards the concave electrode, will have a uniform greenish yellow color.

To tell polarity of high tension induced (faradic) mode, attach a Geissler tube to terminals of coil and start vibrator.



The above cut shows a Geissler vacuum tube for testing the polarity of high tension, high frequency induced modes. A mode passed through this makes the positive end glow red, and the negative end glow with a bluish light. This test should be made in a darkened room.

Static induced mode is tested the same way. The Leyden jar mode on positive side will have a negative polarity, and vice versa.

How do you change the polarity of a static machine?

Connect both prime poles with the ground wires, till the charge is dissipated, then reverse the direction of the revolution of the plates, for a few turns, then reverse again and turn them contra-clock-wise, and start as at first.

What causes loss of static charge?

When a machine does not generate, it is said to have "lost" its charge. This condition may be due to a number of causes. Plates revolving in the wrong direction. Dust, gum, oil or moisture on the plates. Rotten shellac on the surface of the plates. Worn-out brushes. Loosened plates. Neutralizer rod or wire disconnected. Displaced collecting combs. One or both poles grounded. Leaving the sliding rods short-circuited.

What precautions should be taken with a static machine?

Remember that the man with the static machine always has trouble coming. It may not come to you. I have seen very poor machines generate well under the adverse circumstances, while on the other hand I have seen some of the best makes utterly refuse to work under the most favorable conditions. I groomed a fine, beautiful machine carefully for two days, and it did well for three hours and then quit, and I had to tickle it up with a chain from another large machine in the next room every time I wanted

to use it, and even then it would sometimes refuse to work. I had it in a dimly lighted, cold room, surrounded by brick walls. Another man took it to the second floor of a frame walled room, under a bright skylight, and it has been working well ever since. I took a small homely, cheap rubber plate machine out of the box in which it came, all dusty with excelsior, and set it up in a room which was freshly scrubbed and still wet, right by an open window with a rain storm raging outside, and before the case was put on, it gave a fat six-inch spark and did good X-ray work for several months. It was sent to the mountains of Tennessee and it has never done a bit of work since. If you take the proper precautions, with the right kind of a machine, you can expect and get uniformly satisfactory results from it. Keep it clean, free from dust and moisture.

TO PREVENT DISAPPOINTMENT WITH STATIC MACHINES

Owners of static machines must remember that moisture and dust on the outside of a static machine are just as injurious as on the inside. Your machine should be cleaned daily on the outside and when the air is perfectly dry, as indicated by the hygrometer, the machine can be opened up to let the ozone out. The machine to render the best service, must have good care, just as much as a person. The machine should stand from the wall, so that you can wipe it off clean every morning. It is a good plan to take a chamois skin or piece of cheese-cloth and run over the electrodes and fixtures in front of the machine before seance. The case should be as nearly air-tight as possible by puttying up all openings and then shellacing over the putty on the inside. This should be looked after thoroughly at least once a year. Doors should always close on strips of felt to prevent dust and air from entering. It is a good plan to take the machine apart at least once a year and thoroughly clean the plates and all metal parts, in order to get the best results.

If the coating on the glass plates does not show perfect insulation, the old coating should be entirely removed with alcohol and five fresh coats put on, although this is not necessary if the instructions given further on are followed. The necessary material, including camel's hair brush for recoating the plates and work will cost you $3. If your static machine changes polarity when running, it shows it needs cleaning. In order to clean the plates without removing them, use a clean woolen cloth slightly dampened with alcohol. But the cloth should not be wet. Great care should be taken so as not to injure the coating on the metal parts. All coating on the inside should also be cleaned the same way and with the

same amount of care. If the inside fixtures are made of brass and are tarnished with ozone and cannot be cleaned as above directed, they should be removed and put in strong soap suds and heated to the boiling point, so that the lacquer will soften and scale off. Add lye to the solution, and it will hasten the process. When the old lacquer coating is softened, remove the parts from the water and clean them with a dry cloth quickly when they are hot, then brighten them with common whiting and recoat at once with lacquer.

From June to September, the machine must be kept in first-class condition or it will not work. Every static machine will work if the plates are clean, the brushes in good condition and the air on the inside of the case dry.

Those who have never taken proper care of the static machine by opening up the case on dry days and allowing the ozone to escape, will find a coating has formed over the plates, and for this reason there are many machines which will not do satisfactory work. It is a good plan to use precaution to prevent the machine from discharging, especially in warm weather after using the machine, by removing all portable attachments, as connecting rods and ground chains. Every owner of a static machine should have a hygrometer, which should be hung on the inside of the case to indicate the moisture in the atmosphere. Should you have a hygrometer on the outside of the case or in the room, and it registers 30 or more, it shows you are near the danger point. The best dryer is 30 lbs. of calcium chloride (not lime), placed in a glass or enamel trays inside of the static machine. Before placing in the machine, it should be baked in an ordinary cook oven until it is thoroughly dry and takes on the appearance similar to common salt. After it has been used several times, it will form one solid mass. With a hammer, this should be broken up before placing back in the machine again. Never allow the calcium chloride to remain in the machine with over half an inch of water in the bottom of the dishes, and it is a better plan to remove the calcium at least once a month and bake it thoroughly.

Shall I buy a static machine or coil?

What shall I buy—a static machine or a coil? This question is asked with unvarying regularity by every man who wants to do electro-therapeutic work. Here is the answer: If you wish to become an X-ray specialist, get a good coil (not less than 12-inch). If you want to do general electro-therapeutic work, including X-ray work, get a static machine. For therapeutic X-ray work the static machine answers as well as

a coil. For radiographic work the coil is the thing. For high frequency work the static machine is, other things being equal, superior to the coil. The coil does better radiographic and fluoroscopic work. In all other respects the static machine is preferable. If you want to be perfectly equipped, get a coil *and* a static machine. (See page 221.)

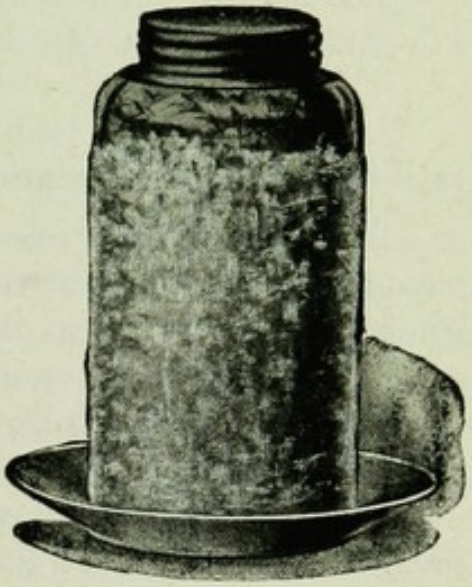
HOW TO MAKE YOUR STATIC MACHINE WORK IN MOIST ATMOSPHERE

The man with a static machine, usually, and in fact nearly always, has troubles of his own, especially during the hot, moist weather of the months of July and August, and along rivers, lakes and the coast.

Static machines are variable and fickle, but are governed by certain laws which must be obeyed. Moisture and dust are the greatest troubles to contend with. No matter how tight the case may be, dust and moisture will get into it. Some machines are less susceptible to the atmospheric conditions than others, and, notwithstanding the claims made by makers, there is no machine that can be depended on to generate always, under every circumstance and condition. We may so alter the circumstance and modify the conditions that we can be reasonably sure of our machine working, but never be absolutely certain of it.

Some machines have a smaller machine, or charger, inside the case, in order to start the mode and charge the larger plates, but even then they sometimes fail to work. The glass and mica plates should be covered with a coating of shellac. Hard rubber plates are left bare. Various methods have been tried to keep the air inside the case free from moisture, such as lamps, incandescent lights, electric coil heaters, jars of sulphuric acid, common lime and chloride of calcium; but lamps, light and coil heat too much, acid gives off destructive fumes, lime dust flies. The most generally used and probably the most satisfactory, when all else is considered, is fused calcium chloride. This is not the ordinary chloride of lime of the stores, which is chlorinated lime, or bleaching powder, which gives off the fumes of chlorine gas, which will ruin the metal parts, but the fused chloride of calcium, which comes in rough, hard lumps. It should be thoroughly baked, bone-dry, in a deep, flat granite or earthen vessel and kept inside the case, all the time. Being very hygroscopic, it quickly absorbs all the moisture in the case, and keeps the air within quite dry. As it gets wet it becomes soft and sticky, and should be then removed and again thoroughly dried or baked. Do not allow it to get on the stove or metal part, as it will ruin it, but when carefully handled it is safe and

reasonably sure. The same calcium can be used over and over indefinitely. Probably the safest, quickest and cheapest way of drying the case is the jar of cracked ice and rock salt. Do not use snow or common salt, or forget the saucer, but use as follows: Take a one-quart glass fruit jar with screw top, fill with a mixture of chopped ice and rock salt, screw down the cover and wipe the moisture from the outside of the jar; place the jar in a saucer or bowl inside the case of static machine, close the door and set the machine in motion, keeping the plates moving until the machine begins to generate at its best. After, say an hour, when the ice is nearly melted, remove the jar and quickly close the end door, so as to prevent the outside air from getting into the case. This simple remedy will dry the air within the case in from five to twenty minutes. Materials for this experiment are accessible to every physician at all seasons of the year, and the application of this remedy is entirely free from the danger of corrosion of the metal parts of the machine and the annoying care and labor of frequent drying and baking of chloride of calcium.



Apply the remedy when next your machine refuses to generate, and it will insure the very best of results in the operation of your machine on any and every day in the year.

Simply holding a pledget of absorbent cotton against the revolving plate, while in motion, will often cause the machine to generate at once, especially the rubber plate machines.

What precautions should be taken in giving static treatments?

In giving static treatments be careful not to approach too close to the patient, for you may accidentally draw to your patient a discharge, in the form of a spark, which will be painful, or at least unpleasant, and which may frighten, or annoy, so that they will not return, and the effect may even be harmful.

Always have female patients remove their hats, and also the pins from their hair, if made of wire or celluloid. Always begin with a short seance, and a mild treatment, to new patients. Avoid sparks as much as possible. Make no spark application to bony prominences, or to the nails, or to the nipples, or the organs of special sense.

Do not concentrate a series of sparks, or a brush discharge to metal buttons, or to corset stays. You may blister the skin beneath. Have the overhead crown just far enough away to be distinctly, but not unpleasantly, felt. Remember that you can do good or harm with a static machine, and do not make a show, or have fun with it at the expense of the patient or his friends. Do not abuse a good thing.

The uses of static sparks ought to be discouraged. The static breeze will usually do what sparking can do, and is by far more agreeable.

In what condition is static electrification indicated?

In giving dynamic electrification, we must necessarily make the treatments largely local, whereas we can rarely make a static treatment local. When the patient is on the insulated platform, we may concentrate the most of the effects to some part, or local area, but we cannot prevent the excess from traveling all over the patient, thus giving him a general treatment at the same time.

With a proper diagnosis, and a full realization of the needs of the individual case, and a full knowledge of the technique of the treatments, the man with the static machine can accomplish wonders, and do it so safely, quickly and pleasantly, and withal so profitably to himself, that he will no longer resort to the older and slower, and more disagreeable methods of the past, when once he gets started in the new ways.

Do not get the idea that static electrification will do everything, or that it is a cure-all, or that it will take the place of galvanism, or faradism, or drugs, in all cases. If you start out with that idea, you will be disappointed, and are only laying up for yourself trouble. Static electrification has its place in our work, and in many instances it has a place which nothing else can fill. Use it in conjunction or in alternation with the other modes, and get a combination which cannot be excelled.

There are some advantages in giving this treatment over all others. It may be applied, either generally, locally or both, without disrobing, exposure, or the annoyance of delay. For this reason it is popular with the women, who are usually our best patrons. Again the treatments take less time, as there is none lost in preparation before or after the treatment. Then you may treat a number at a time, if desired. For instance, the platform is usually large enough for two stools upon it, or a mother may hold her child on her lap. You may treat infants this way, which you could not do with any other method.

In static electrification, we possess one of the most useful agents for

the relief of painful and diseased conditions, and when properly applied will usually prove beneficial, and where tissue metabolism is to be stimulated, or elimination and excretion to be hastened, there is probably nothing superior.

As a restorer of the normal electric equilibrium, it probably acts more generally and quickly than anything else. General catalytic or nutritional effects are more quickly produced with static, than with the other modalities.

How does electrification cure diseased conditions?

Electrification cures diseased conditions in three ways. The purely mechanical, by phoresis, by means of which we may force directly into the tissues, drugs or compounds of the metals, thereby getting the local effect of the materials so employed; by electrolysis, which is a purely chemical process, by means of which we are able to break up the tissues of the body, by a chemical process of decomposition, or dissociation of the component parts, with the liberation of the elemental gases, and getting the local polar effect of the acid and alkaline radicals upon the healthy and morbid tissues. Both phoresis and electrolysis are more or less local, and therefore limited in action and effects. By catalysis, which is both direct and reflex in effect, and is both local and general, and is therefore by far the most important effect of electrification in all of its varied modalities. The nutritional effects through the complex vaso-motor nervous system, is at once most important and far-reaching of all the results of electro-therapeutic applications, and is the keystone of the whole science.

Electrification appears to effect its curative results first in acting as a general tonic to the entire organism. By stimulating the circulation, the whole vegetative system seems to put on renewed action. Glandular secretions are increased, absorption promoted, the waste of the system is carried off with greater rapidity, repair is hastened in still greater proportion. Nutrition is increased, the vital nerve force is endowed with greater strength, and the whole well being of the organism becomes improved to a wonderful extent.

Electrification begins its remedial effect immediately upon being applied, and is much more prompt in its action than are most drugs.

Electrification avoids hemorrhage caused by many operations.

Electrical treatment obviates the necessity of an anæsthetic.

Electrification produces a powerful physiological effect, which in many instances is of great value.

It does not retard the action of any remedial treatment that may be used, as is frequently the case when different drugs are employed.

The science of electro-therapeutics is one of the most tangible, positive and practical in the domain of medicine and surgery. And the physician who attempts to ignore or belittle its claims is simply displaying his own ignorance and getting in the way of a power that will speedily convert him or sweep him aside in its onward progress. In the field of surgery its demonstrations are open and undeniable. The electro-cautery and the galvanic modes are positive and palpable in their work on the tissues and morbid growths, in phoresis. The galvanic and faradic modes in general diseases and in diseases of the nervous system are applicable in the widest range of troubles, and yield results that cannot be accomplished by drugs, exercise or massage alone.

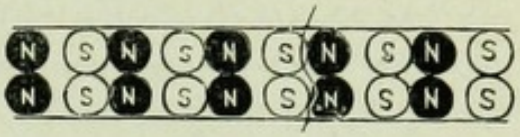
To those who are skeptical we do not wish to bring a new doctrine, but would refresh their minds on subjects that are old in this connection. A glance will show that the entire nervous system receives and transmits its impressions and influences purely as an electrical battery, which it is essentially. When we consider that every element in our bodies is either electrically negative or positive, we must see that we are the most thoroughly constructed, sensitive and readily affected electrical machine that can be found.

MOLECULES, ATOMS, CORPUSCLES, IONS

We have been taught in school for years, in the study of physics and chemistry, that the molecule is the smallest particle of matter that can exist in a free state, as matter, partaking of all the properties of the mass, and that a molecule consists of two or more atoms. We are also taught that the *atom* was the smallest divisible particle of matter and that it was supposed to be about one twenty-millionth of an inch in diameter. More recently we have been working on a later theory that even the atom was a complex body, containing one thousand other smaller particles, which are called *corpuscles.* Now we go a step further toward infinitesimalism, and believe that even the corpuscle is a community, consisting of *ions,* which are one five-thousandth of the diameter of a corpuscle. Now, going down through the division of the scale, through the successive stages of imaginative conception, through the different theories, viz.: *molecular, atomic, corpuscular* to the *ionic,* with our pencil we can figure out the supposed size of the ions. Thus, we find that one hundred quadrillions (100,000,000,000,000,000), or one hundred thousand thousand millions of ions can be

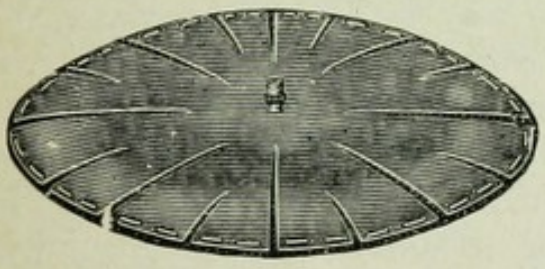
placed on the flat point of a needle, which is small enough to go inside the central canal of the finest hair you ever saw. Can imagination go any further? Whether this is correct or not, and it remains yet to be proven or disproven, we only offer it, not as a practical fact, but to further carry out our statement previously made that each ultimate particle of human tissue is independent and free to move, and is possessed of its own individual polar

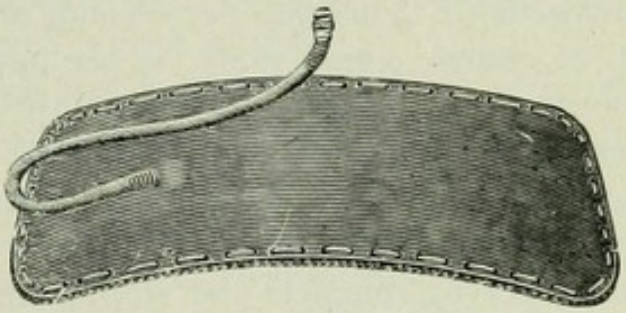




affinity, and follows the laws of electrification, that likes repel and unlikes attract. Therefore, if we conceive of such a condition, it will help us to understand how electrification can exert its catalytic effect upon the vaso-motor mechanism, controlling circulation, and also the endosmotic and exosmotic processes, by which nutrition is affected.

What advantage has large dispersing electrodes?





Large dispersing electrodes have the two-fold property of, at the same time, increasing the diffusion, and lessening the density of electrification, and by means of the proper appliances, we are able to so modify our treatments, and effects, as to adapt them to a wide range of usefulness. A thorough understanding of the law of Ohm is essential and easy, both to demonstrate and apply, and it enters into every equation of treatment by electrification.

The resistance of the skin, which is very great, is diminished by enlarging the electrodes, which allows greater diffusion of the dose. If the dose be too strong and applied too long a time at a given place there appears at the positive an eschar from acid reaction. At the negative, ulceration from alkaline reaction. The electrodes should be moistened with a solution of chloride of sodium; this is a better vehicle than water, for the reason that the positive takes the chlorine and the negative the sodium ions.

What are high frequency modes?

The consideration of this subject has assumed so much importance recently, that we offer a few items of interest concerning them, with some observations and experiments, and the conclusions deduced, which we hope will be useful to the beginner. While the use of the so-called ultra-violet ray has been extensively exploited but lately, it is by no means new, as there are well known physicians who have been using and experimenting with them for the past twenty-five years.

The so-called high-frequency mode is derived from either an ordinary X-ray coil or static machine, and is usually passed through an apparatus consisting of a specially constructed inductions coil, arranged in series with Leyden jars, and an adjustable spark gap.

The Leyden jar plays the part of the condenser in the production of the high-frequency discharge. The mode is induced in the outer armature of the jar and thence passes into the high-frequency coil. The primary mode passes between the terminals of the sliding rods.

This produces a mode with very rapid periods, running up to many hundreds of thousands per second, and a voltage up in the millions. This is, of course, guess work, as we have no way to count or measure such things, but the figures are certainly low enough. The rapidity and pressure is governed by the size and speed and capacity of the generator and apparatus employed. With such great stress, the air is no longer an insulator, and the effect is seen at a distance, with or without conductors. It is not necessary to complete the circuit, and the treatments can be given from either terminal. There is marked difference in the phenomena, effect, and feeling, from different poles. Vacuum tubes placed near either pole will glow, and if connected direct will light up more strongly, and if brought near the body will emit the ultra-violet rays. This demonstrates the passage of the mode through space. These rays have considerable penetrating power, and on account of their ease of generation, and safety of application, may be more valuable as a curative agent than the X-rays. They can be applied internally as well as externally. They seem to be analgesic, anæsthetic, and antiseptic. They affect the blood supply through the catalytic action on the vaso-motor nerves increase arterial tension and stimulate absorption, secretion and excretion. Their antiseptic, or bactericidal power is probaby due to the great amount of nascent ozone liberated. They are therefore useful in parasitic skin diseases, microbic infections and suppurative conditions. The affections most amenable to the ultra-violet rays are pulmonary consumption, tubercular ulcers, glands and joints; gleety, gonor-

rhœal, gynæcologic, and urinary troubles; cutaneous, cancerous, and lupoid diseases; rheumatic, gouty, arthritic, and lithemic states; nervous affections. There are numerous methods of application.

The same rules govern the high frequency treatments, that apply to all the other forms of electrification, as regards the polarity.

What are high voltage modes?

High voltage modes are those which are derived from a static machine or an inductorium, and have very high potential, so much so that they will overcome great resistance, and leap across spark gaps of considerable distance.

When derived from a static machine they are usually secondary or the induced form. A condenser in the form of a Leyden jar is in series circuit, and one or more spark gaps may be introduced.

This gives a rapid interruption and imparts an oscillatory character to the mode which sets up rapid waves or vibrations, of such great frequency, as to be beyond the point at which muscular contractions are caused.

When derived from an inductorium, the modes are the same as the ordinary faradic form, but with a much higher tension.

Sometimes several induction coils are superimposed upon each other, the secondary of the first one being used as the primary of the second, and this second secondary being used to energize the primary coil of a third inductorium, etc. Thus each step up in the process of induction greatly augments the tension or the voltage. The same way a number of condensers or Leyden jars may be coupled in series, either with a static machine or with a coil, or both may be used with a coil.

There is no amperage about these modes, which accounts for the immunity from danger in taking or giving treatments with them. It is supposed that the beneficial results derived from the use of these high frequency, high voltage, oscillatory modes depend upon the vibrations imparted to the tissues, which stimulates metabolism, thus rearranging the electrons into their normal relations, and stimulating the elimination of the effete matter produced by retrograde metamorphosis. It is a well-established fact that great good can be derived from these treatments, especially in nervous functional derangements.

A high tension mode may be applied to the patient by passing the derived mode through a large coil of wire, which is insulated from the earth, and so arranged that the patient either wholly or in part, is immersed in the field or rapidly oscillated influence which will be created within the coil. The effect may be modified by means of the primary spark gap, so that a

thrill either mild or vigorous may be felt, and either a strong or mild stimulation given the patient. Usually only one pair of Leyden jars are connected between the static machine generator and the diasolenic coil.

THE DIASOLENIC ZONE

What is a diasolenic zone?

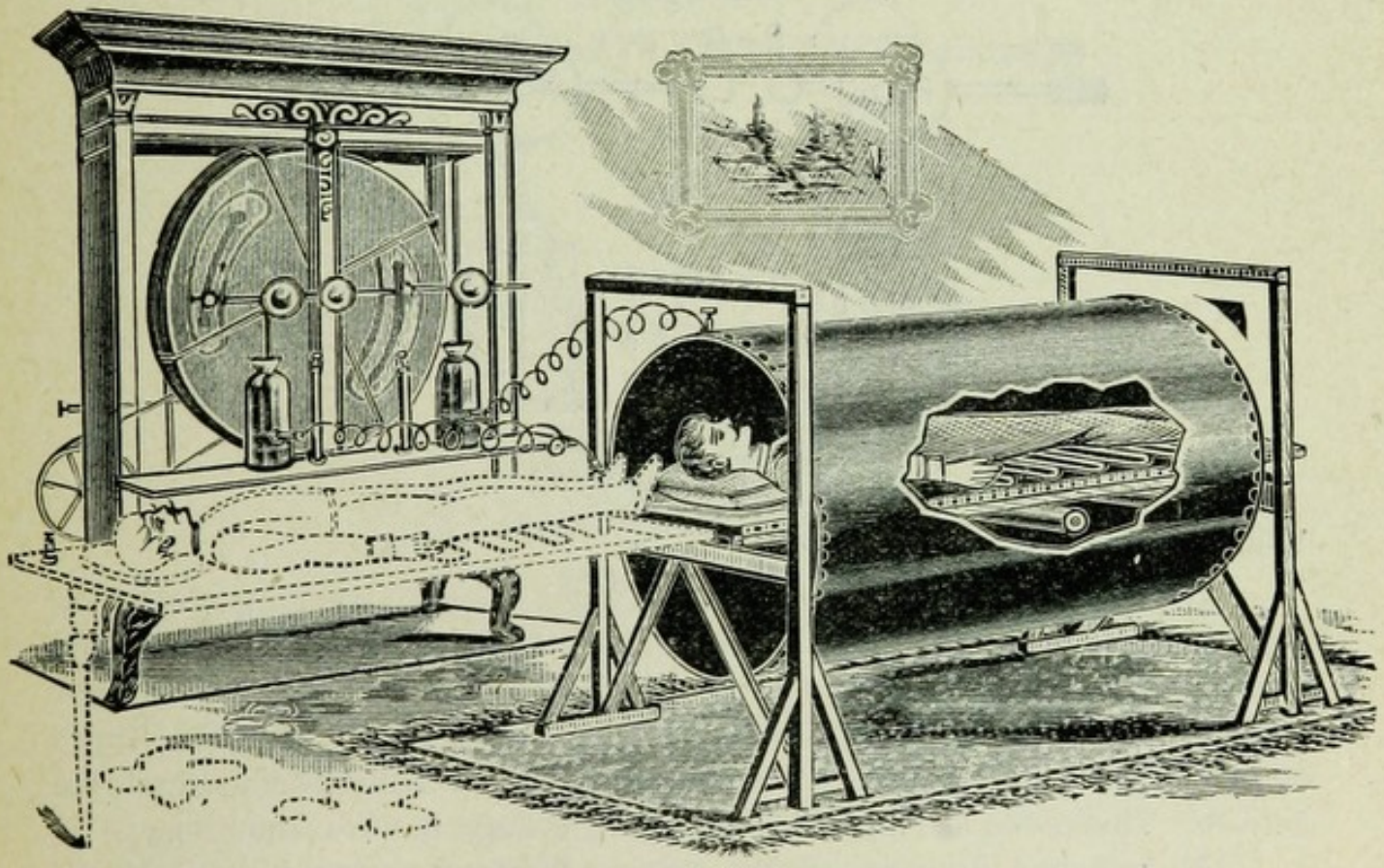
This field of influence is called the diasolenic zone, and this method of treatment and nomenclature is to be credited to Dr. Otto Juettner, of Cincinnati, who first brought it to our notice.

Here are a few points concerning the clinical uses of a valuable attachment to the static machine. The so-called "diasolenic" is a large hollow cylinder made of pasteboard which is covered with a layer of asbestos, over which many thousand feet of insulated wire are wound. Both the outside and the inside of the cylinder are covered with some suitable matter, preferably thin imitation of leather which is durable and gives the cylinder a neat appearance. One end of the wire is secured by a binding post. The diasolenic should have a length of at least three feet and a diameter of not less than one foot. The cylinder should be made large enough to admit an arm or leg or even the whole body of a patient without touching the sides. The full mode from a static machine condensed by two large Leyden jars is sent through the wire of the diasolenic by connecting its binding-post with one side of the machine. The spark-gap between the sliding-rods should be three or more inches in length. The diasolenic should be suspended from the ceiling or from a suitable stand. It should be absolutely insulated. While the mode is passing, the air inside the diasolenic is literally alive with electric energy. A glass-electrode held inside, without any wire or cord attached, lights up instantly. A distinct thrill or vibration is communicated to the hand held inside. The sensation is not a static breeze, but a vibration of a peculiar kind. It is due to electrical vibrations bombarding each other from all sides. The wires which carry a mode of intensely high electro-motive force are surrounded by an areola of electric energy, whose intensity and extent depend upon the power of the mode passing through the diasolenic wire. This areola of electric energy within the diasolenic cylinder is known as the diasolenic zone and is capable of producing peculiar effects therapeutically. Its vibratory thrill is communicated to the tissues of the part held inside. Every corpuscle is charged and thrilled in response to the waves of electrical vibration attacking it from every side. The effect is distinctly tonic and stimulating, resulting in intensified metabolism. Subjectively the sensation is pleasant, restful and invigorating. The diasolenic zone has every advantage of the

solenoid which is used in connection with the alternating mode. As an attachment to the static machine it is an attractive and useful novelty.

What is the diasolenic mode?

The Diasolenic Mode. If the static mode condensed by Leyden jars is allowed to pass through a diasolenic, the attachment being made to one side of the static machine, effects resembling the high frequency mode may be produced. For this purpose the diasolenic is fastened on top of the static machine, one end of the diasolenic wire being connected with either side of the machine, the other end being attached to a glass-electrode by means of a cord. The spark-gap should be two, three, or more inches. The application is made with the glass-electrode in the ordinary way. Care must be taken to hold the cord at sufficient distance from the metal parts of the machine. If the electric zones, surrounding the metal parts and the cord should happen to touch, the mode is short-circuited and this electrode will not light up. The therapeutic indications are the same as those of the high-frequency mode. (N. B.—The word "diasolenic" is derived from two Greek words: "dia," which means "through," and "solen," which means "tube.")

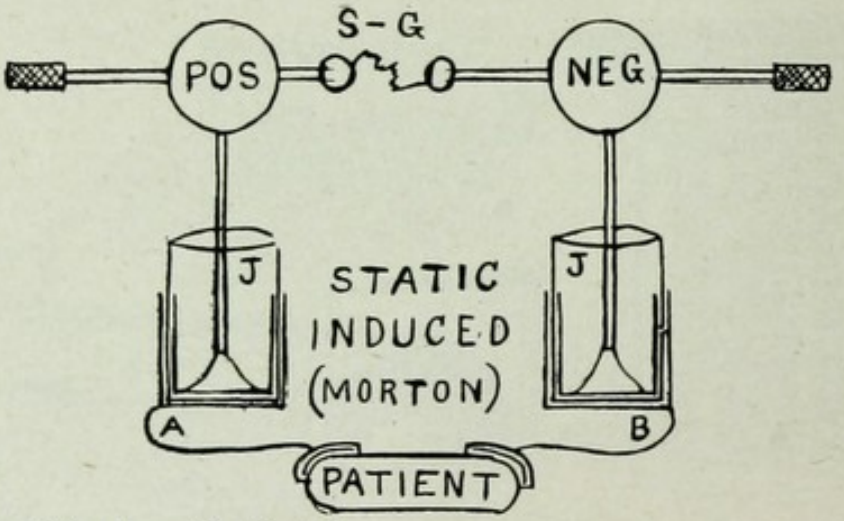


The Diasolenic Bath. The apparatus consists of a huge diasolenic tube, 5 feet long and 3 feet in diameter, which is mounted on a suitable

stand from which it is suspended by four chains. It hangs freely in a horizontal position, not touchng any part of the stand. A platform, 6 1-2 feet long and 2 feet wide, is placed inside of the tube, resting upon the aforesaid stand and not touching any part of the diasolenic. The platform can be rolled in and out. The diasolenic proper is covered with from 2500 to 3000 feet of wire while the platform is covered with about 1500 feet of wire. The mode is taken from one side of the static machine, the Leyden jars being properly connected. The wire from the static machine is connected with a binding-post on the platform, the mode running through the 1500 feet of wire on the platform to a binding-post from which it passes to the diasolenic proper. (The word, method and apparatus originated with Dr. Otto Juettner.)

What are the high frequency methods?

(A) The Morton method.
(B) The d'Arsonval method.
(C) The Tesla method.
(D) The Oudin method.

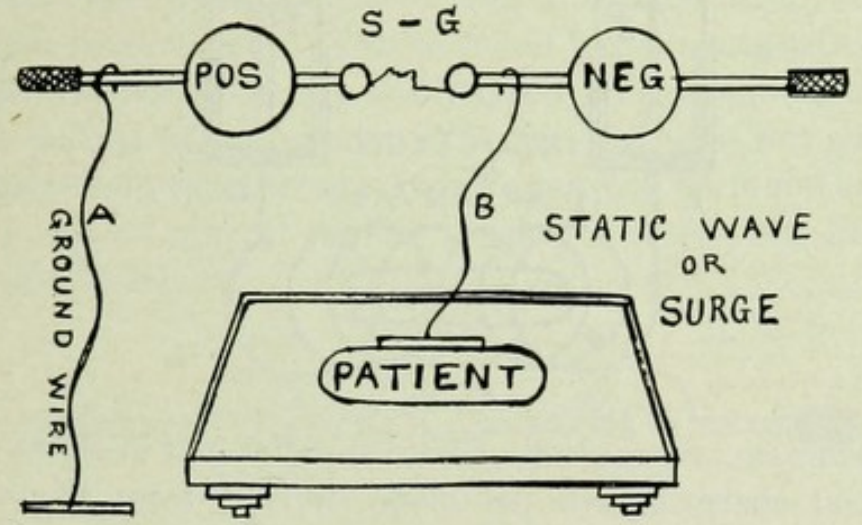


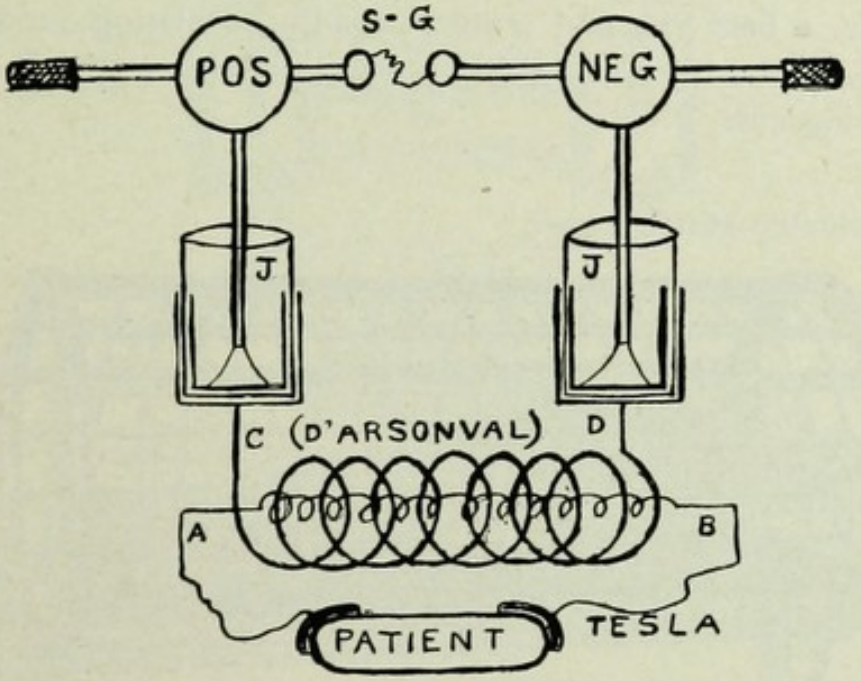
What is the Morton Method?

The Morton method consists of giving a wave or surging treatment, from a static machine. The patient is placed on the insulated stool, and connected to one prime pole, and the other grounded. Or the connection is made to the outer armature of one jar, and the other grounded. The length of prime spark gap causes a wave or surge of electrification to reach the patient. This mode has high frequency and voltage but low amperage.

The attached drawing of the static (Morton) induced mode shows the patient connected to the outside of both jars. In the Morton surging or wave treatment the patient is only attached to one electrode, either A or B

and the other one grounded. Or the patient may be connected to one electrode attached to either the positive or negative prime pole, and the other grounded. Either of the Morton treatments may be modified by also grounding the wire connected to an electrode placed on the patient. That is, either wire A or B shown in the drawing may be dropped to the ground, with the patient on the insulated platform.



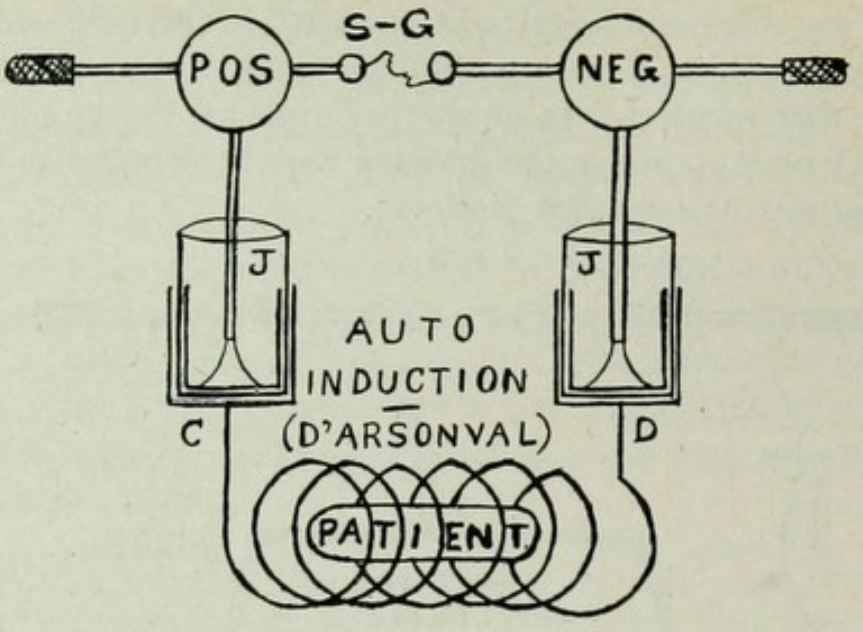


What is the d'Arsonval Method?

The outer armatures of the jars are connected by a short heavy wire solenoid, and the patient is placed in the field of a shunt from this circuit. It is given by the bi-polar way, with both electrodes in direct contact, and also by two indirect ways, viz:

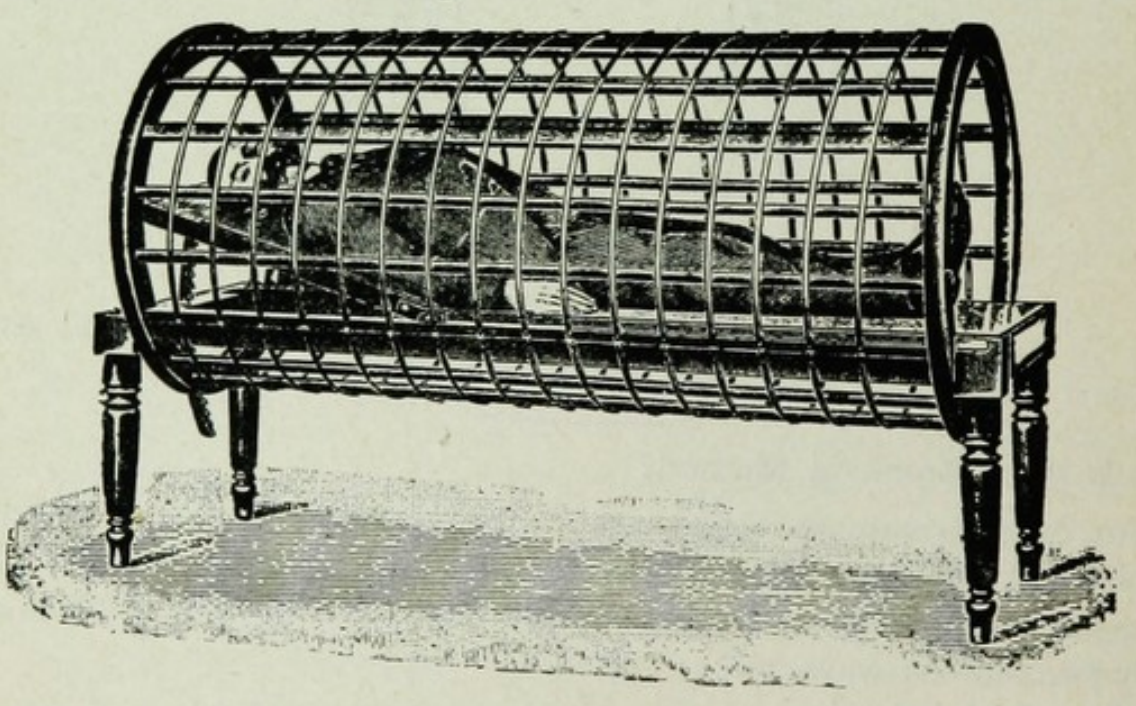
(A) Auto-induction.

(B) Auto-condensation.



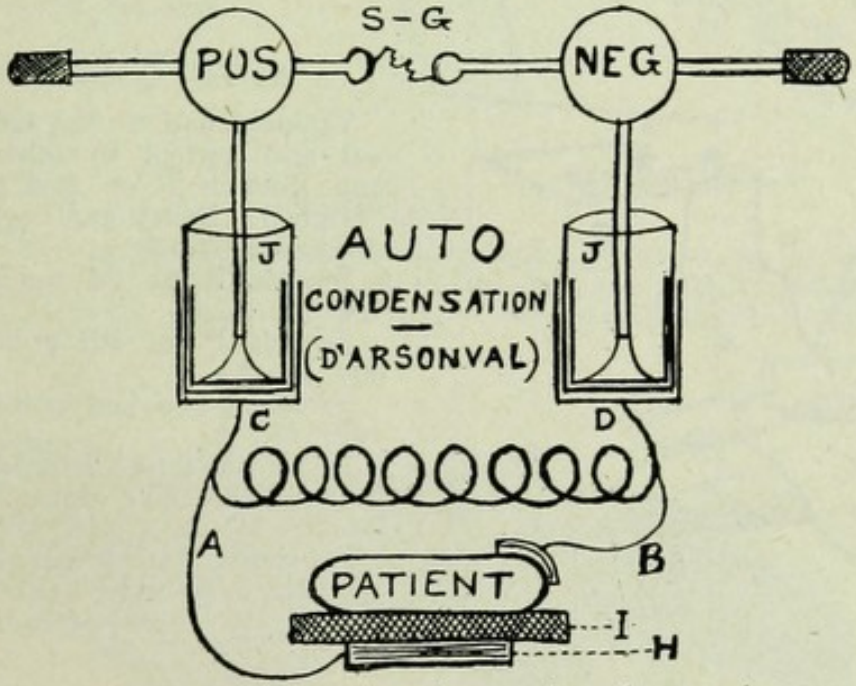
In auto-induction, a large coil of wire is connected in shunt circuit with the primary coil charged with the mode derived from the outer armatures of the jars. The patient is insulated from the coil about him, and he is placed in a field charged with a rapidly oscillating mode. This is called the "cage," and it may be either vertical or horizontal. It is shown in the accompanying cuts.

What is the electro-static cage?



The above cut shows the large high frequency, or alternated mode body cage, made after the pattern of d'Arsonval, in which the patient is placed and about him is thrown the oscillatory mode field. This method

of treatment is especially useful in asthenic conditions dependent on impoverished blood, and has been extensively used on the continent, in the treatment of pulmonary tuberculosis, asthma, pertussis, and various other respiratory and nervous troubles. It may be used with the alternated dynamic mode, and results secured, which rival those obtained from the auto-induction cage, when connected with a high frequency apparatus from a high tension inductorium. This solenoid has no magnets in connection, hence the field is not as strong as the ones with magnets, but on account of the great weight of a magnet coil of this size, it is not advisable. This is to be connected to the alternated mode, and will be found especially beneficial in all forms of general debility, weakened states, and in convalescence from continued fevers, etc.



In auto-condensation, the patient is so placed as to become one capacity of a condenser. One wire from the shunt circuit is connected to a plate, which is insulated, upon which is placed the patient, who is connected to the other terminal of the shunt circuit.

The d'Arsonval mode has high frequency, medium voltage, and high amperage.

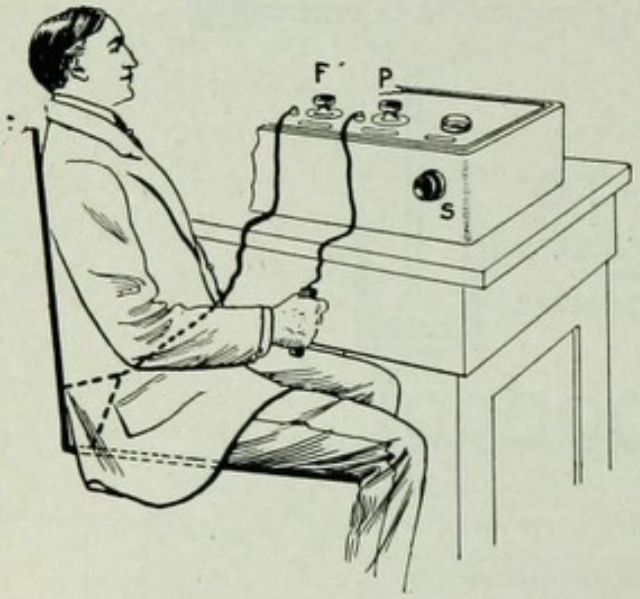
THE "AUTO-PAD" FOR AUTO CONDENSATION, AUTO CONDUCTION, AUTO INDUCTION

In order to obtain the full benefit of the d'Arsonval mode some form of condensation couch or chair is necessary. Heretofore apparatus for this purpose has been cumbersome and expensive. To meet the de-

mand for an inexpensive article, at the same time efficient, portable and inexpensive. Dr. C. H. Fessenden devised a simple apparatus which he calls the "auto-pad." This consists of two pieces of fiber hinged together so as to fit the seat and back of a common chair. One piece is 13x14 inches, the other is 13x21 inches. On the back or lower side of these pieces is fastened metal plates about two inches smaller than the fiber, these are connected together and both attached to the conducting cord and then covered with leatherette and bound.

While being but little thicker than a book cover, it is so perfectly insulated, that a very heavy mode of high voltage to produce all the therapeutical effects obtained by d'Arsonval, may be used without fear of sparking into the patient.

When not in use it may be folded and hidden. The technique of its use is clearly shown in the drawings shown herewith.



AUTO CONDENSATION

Connect pad to one side of D'Arsonval and patient to other side, as per cut. Switch F on 2nd point (next to "High"). Spark gap regulated to make discharge steady.

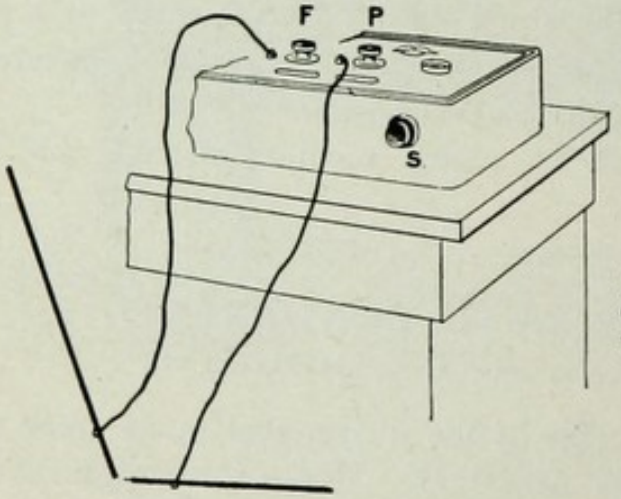
Switch P on 2d point, gives about 400 M. A.

Switch P on 4th point, gives about 600 M. A.

Switch P on last point, gives 800 to 1000 M. A.

According to best authorities the largest necessary dosage is from 500 to 700 M. A.

A similar treatment of about half this strength may be obtained by attaching to thermo-faradic terminals.



AUTO CONDUCTION

Connect each section of pad to one d'A. terminal as per diagram.

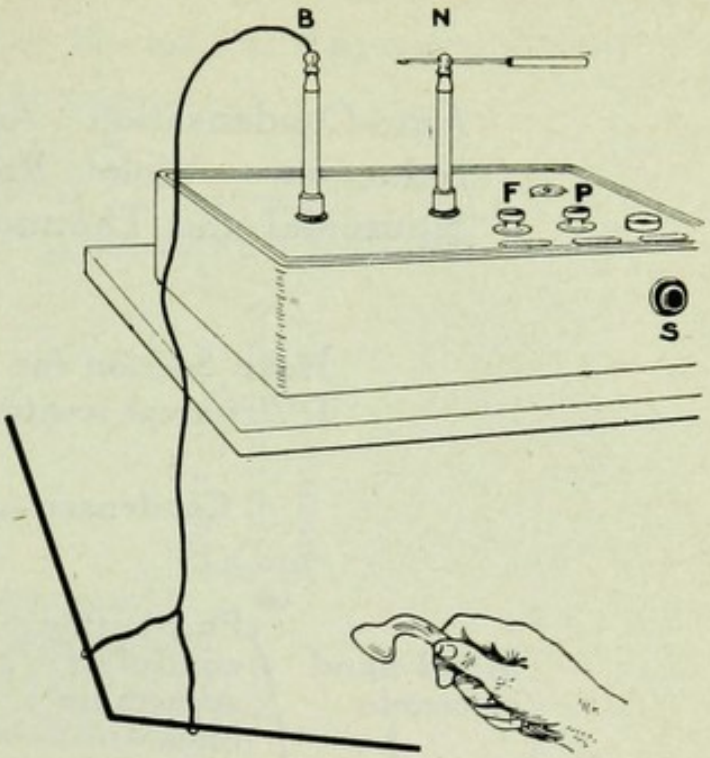
Regulate mode as for auto condensation. Mode strength about 75 per cent. that of auto condensation, and thermo-faradic proportionately weaker.

AUTO INDUCTION

Connect pad to post B, as per cut. Spark gap used as in h.-f. treatment. Switch F on 2d or 3d point. Switch P from 1 to 5 points according to volume desired.

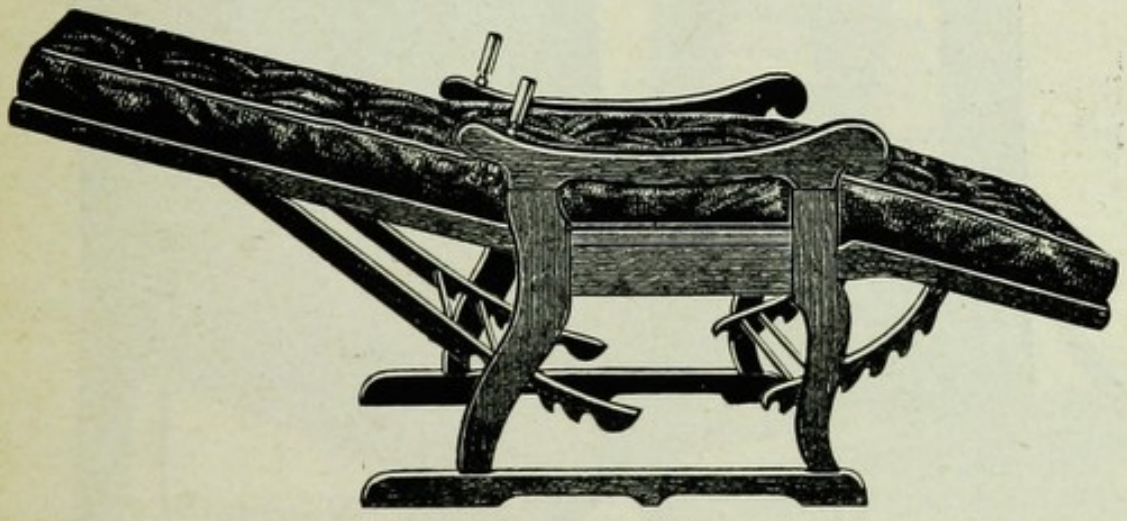
If local application is desired in addition to induction, this may be accomplished by grasping electrode (not insulated handle) in bare hand and applying to desired part.

A more powerful local effect may be obtained by connecting electrode (in insulated handle) directly to post N of the coil.



CAUTION

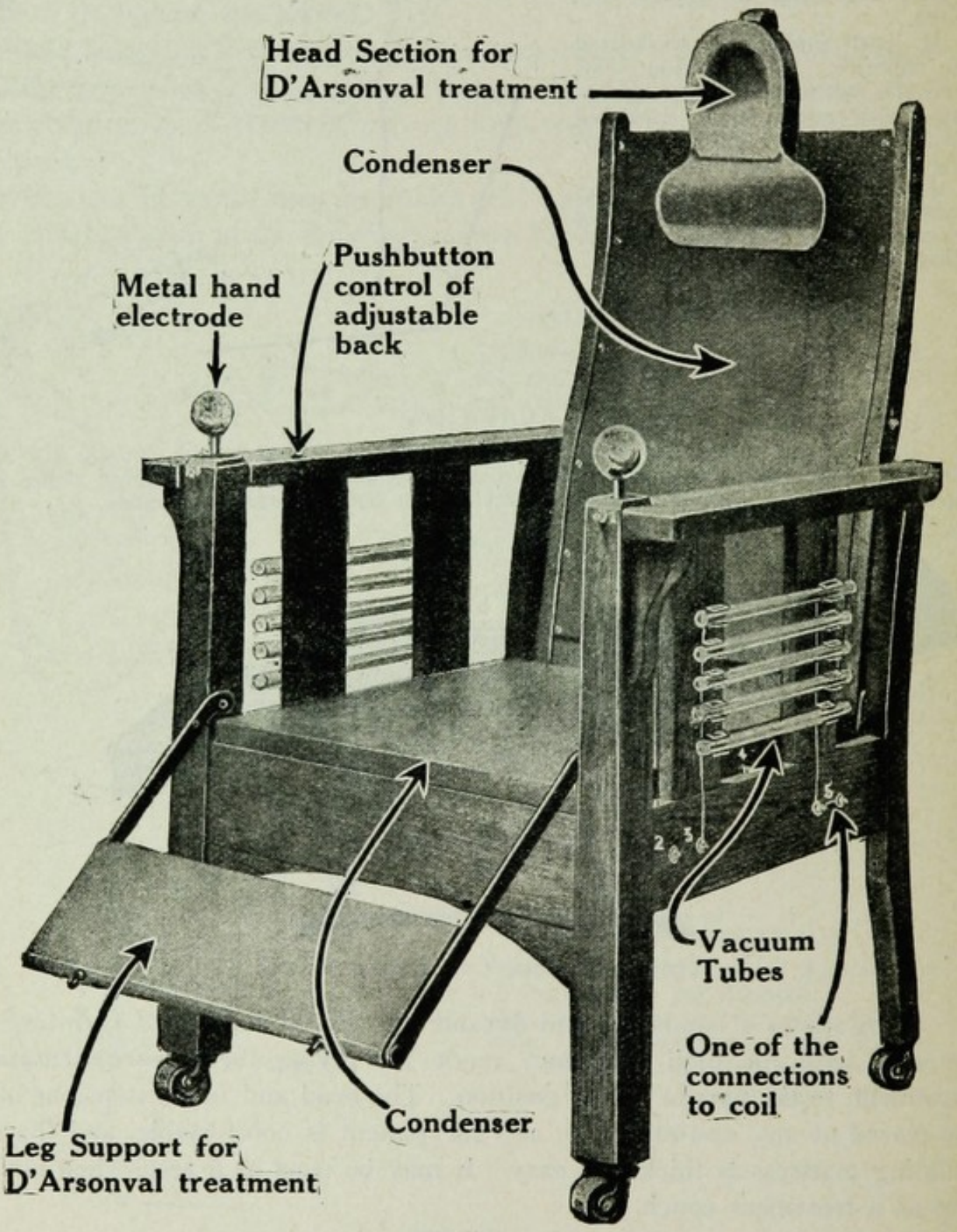
In using the auto-pad be sure that the fibre side is next to the patient, also that the cord connecting the pad with the coil is so arranged that it cannot come into accidental contact with the patient. Seat patient before turning on mode.



Adjustable Auto-Condensation Couch.

This shows a handsome and durable and effective piece of furniture to be used with the high frequency mode for giving the auto-condensation treatment, to the patient in any position. The head and foot extensions may be placed at any desired angle, and the patient is comfortable, and the insulating mattress is thick and easy. It may be used as a rest, when not in use as a treatment couch.

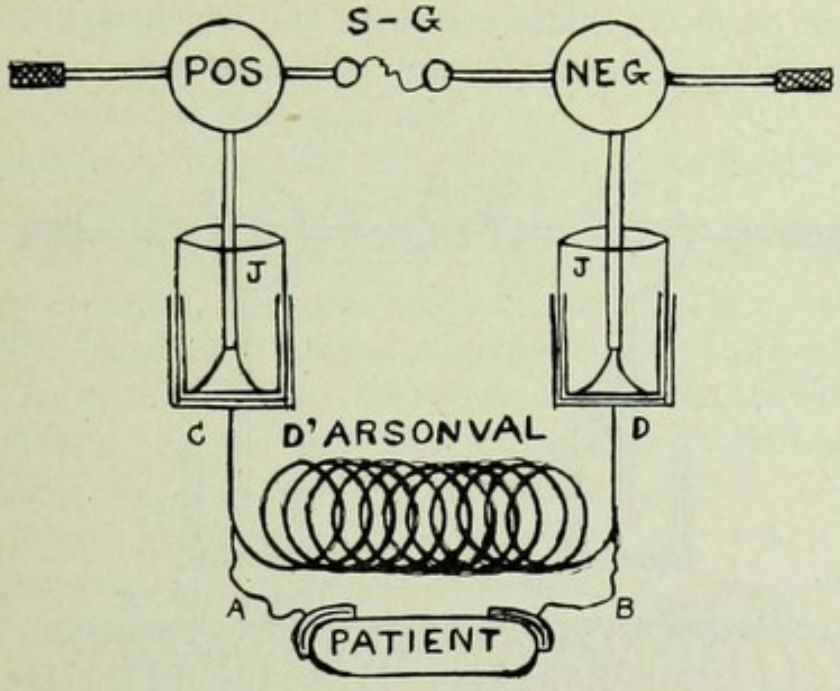
Auto-Condensation—Auto-Conduction—Auto-Induction. Violet Ray—Also for applying Sinusoidal and Thermo Faradic



What is the difference between the Morton and d'Arsonval modes?

The Morton mode is a vibratory mode.

The d'Arsonval is an oscillating mode.



What is the Tesla Method?

This is the one usually derived from the many portable high frequency and X-ray coils sold, and has some resemblance to the d'Arsonval mode, but has higher voltage, and very little amperage, and is most remarkable for the very high frequency and rapid oscillation. It is used in the usual bi-polar way, and is called by some the thermo-faradic mode.

It may be applied with the glass vacuum tube electrodes.

What is the Oudin Method?

This is derived from a secondary wire coil attached to one end of the d'Arsonval solenoid, and is usually applied by the single pole method, with the electrode in contact with the skin, but is more often applied through the various glass vacuum electrodes. It has high frequency, high voltage and low amperage. The apparatus for generating the mode used in the Oudin method is the solenoid resonator.

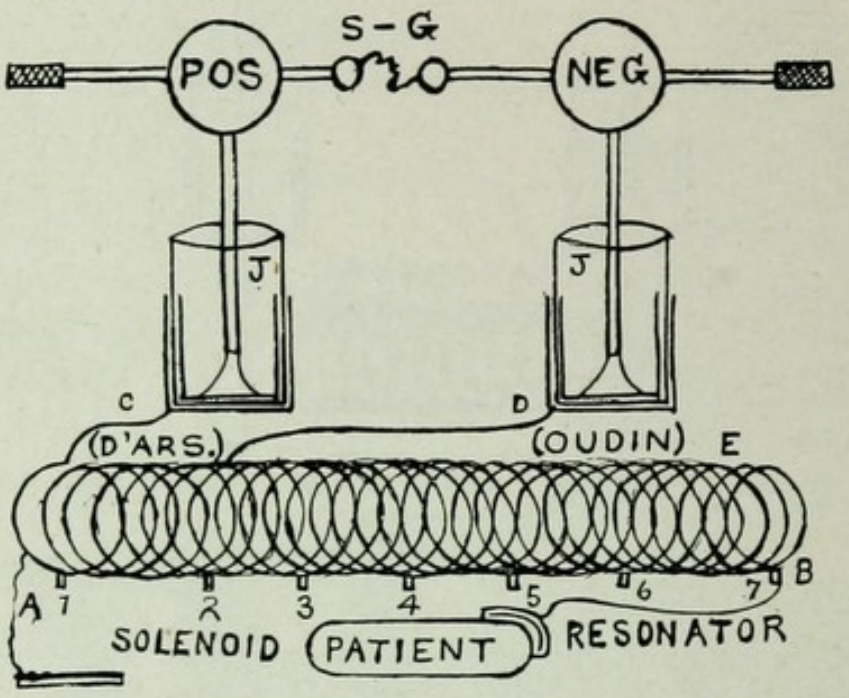
HOW TO MAKE A SOLENOID-RESONATOR

What is a solenoid-resonator?

A solenoid-resonator is a combination of d'Arsonval solenoid, and an Oudin resonator. With it you may get both the oscillatory and resonant high frequency modes.

The accompanying cut shows the scheme of the construction of the solenoid-resonator, which is easily made and is the most satisfactory general purpose apparatus one may have, for use with a static machine.

The old style so-called "German" resonator, which was sold for several years and placed on top of static machines, and which was worthless, may be utilized as a basis for the construction of a good one. If not then make one this way.



For a horizontal apparatus to be placed on the top of the static machine, have turned a stick of wood, either soft pine, or poplar, five inches in diameter and forty inches long. This should be perfectly clear, and thoroughly kiln dried. It may be made twelve inches longer and a round ball turned on either end, for ornaments, if desired.

Cover this thoroughly with three coats of good shellac varnish, each one well dried. Before the last coat dries, coat both sides of the end of a strip of heavy jute express paper, and wrap the cylinder with the paper, coating both sides as you wrap it, till you have two coats of paper.

Allow this to thoroughly dry. Then wind on the wires, and by following the accompanying diagram you will understand how it is done.

Get from your electric supply house some No. 8 rubber coverel copper wire, (the kind used for wiring houses) and make a small loop in the bared end large enough to go around a lead pencil. Through this loop, screw a double binding post into the left hand end of the prepared cylinder, as shown at the point marked with the figure 1, which should be in a lathe or so held as to be easily rotated.

Beginning at figure 1, wind about the wooden cylinder, tightly, and closely together, carefully shellacing as you go, till you have made 25 turns, then cut off the wire, bare the end and make another small loop, as before, and through it screw into the wood, another double binding post, at figure 2. Allow this to dry.

Get some double cotton covered No. 20 copper magnet wire, and a ball of express twine of the same size.

Scrape the cover from the end and make a small loop, as before, and attach it to the binding post base at figure 2.

Wind on this wire, with a strand of twine between each wire turn, to keep them evenly apart, until you reach the end of the cylinder, which will take about 325 turns, or 13 times as many turns of the small wire as of the large. This will give you 13 octaves, as it were, in the secondary, to one in the primary. At the right hand end place a single binding post, in a loop of the bared wire, shown in the diagram at figure 7. If desired a number of other single binding posts may be set at intervals of each 25 or 50 turns, as shown at figures 3, 4, 5, 6. The windings of the small wires should be well shellaced, as put on, and well dried. The whole may be covered, with leatherette, pantasote, felt or velvet, for ornament.

The ordinary large Leyden jars on the front of the static machine have not enough condenser surface. Remove the top, and line, and cover, inside and out with tin foil, from the bottom, to 2 1-2 inches from the top of a jar 5 inches in diameter, and to 3 inches from the top of a jar which is 6 inches in diameter. This foil may be fastened with the ordinary strong mucilage, and should be put on smoothly, and pressed down, so as to remove all wrinkles. This greatly increases the condenser surface. The foil will be about 8 inches high.

Mount the completed solenoid-resonator on the top of the static machine, on posts about 6 inches above the case.

From the base of the left hand jar, run a strand of the heavy rubber covered No. 8 wire, through or beneath, the case, and up the back, and across the top, to the front, and attach the bared end to one hole in the double post at figure 1. Do the same from the right jar, to post at figure 2.

There are usually two binding posts on the front of the base of the machine case, from which to get the static induced mode, and the above wires may be started from these posts.

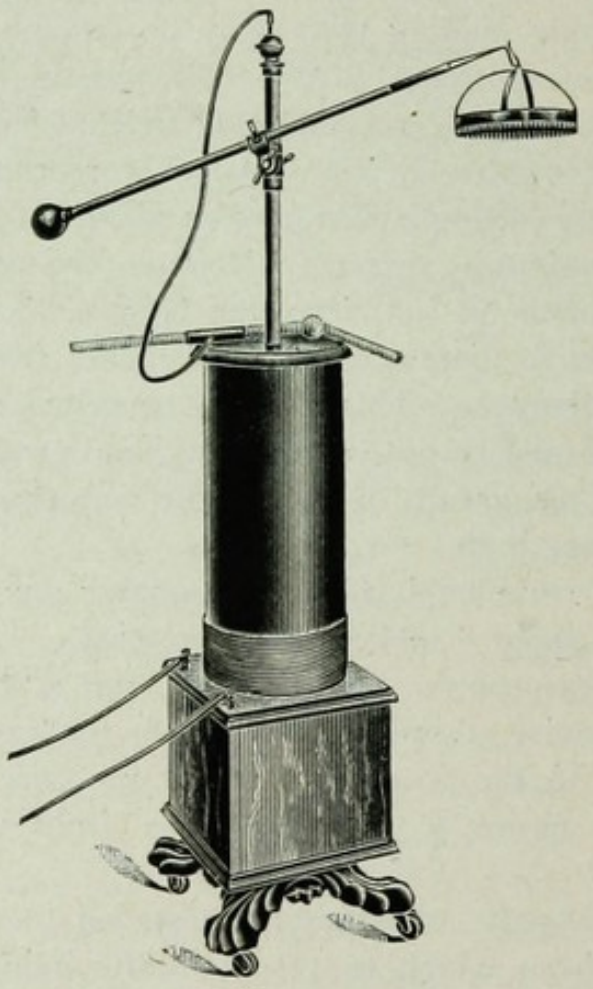
Now with the jars connected to the prime poles of the static, the induced mode from the outer armature or covering of the jars, will pass through the windings of the large wire, and will constitute a d'Arsonval solenoid.

The patients may be treated with this mode by simply attaching the cords and electrodes to the posts on the base of the case, or to the double post on the solenoid, at figures 1 and 2. One cord may be attached to the auto-condensation pad or couch, and the other to the electrode applied to the patient.

The frequency and strength of the oscillation through the d'Arsonval solenoid, and patient, who is in shunt, is regulated and controlled by the rapidity of the machine, and the length of the spark-gap, (S-G), between the sliding rods.

To get the Oudin, or resonant mode, the cord should be attached to any of the single binding posts, 3, 4, 5, 6, 7, according to the volume of resonance desired, the greater number of turns used the milder the effect and the more pleasant the sensation.

The cord, shown at figure 7, in the diagram, may be attached to the sponge covered wet electrode, or to a block tin bare dry electrode, and



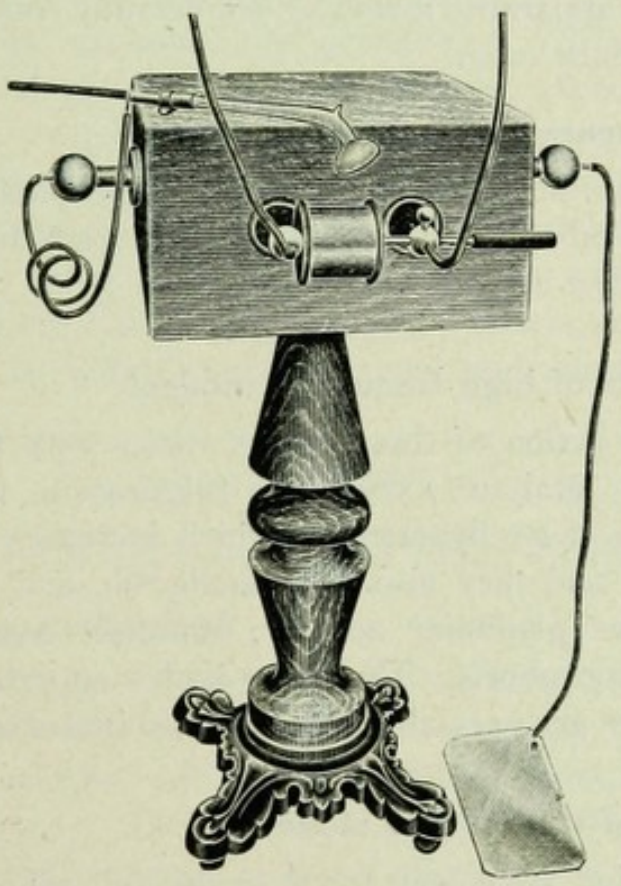
applied directly to the bare skin of the patient, wherever to be treated. Or the cord may be attached to any of the glass vacuum electrodes, and applied to the bare skin, to the cavities of the body, or outside the clothing, according to the effect desired.

In this treatment the patient may or may not be placed on the insulating platform. In this treatment only one electrode is used.

The effect of the resonator treatment is greatly increased by grounding the side of the large coil, by the wire shown at A.

The cost of such an apparatus will range from five to ten dollars at the most, according to how much you do yourself. The material will not cost over five dollars.

The strength and frequency of the resonator mode may be regulated and controlled by the rapidity of the machine, and the length of the spark gap, (S-G) between the sliding rods in the prime poles of the machine. The usual spark being from a half to an inch in length. This will give a heavy shower of sparks and purple effleuve from the body vacuum electrode, from an eighth inch to two inches long, which will be painless, cool and sedative. The same length of spark from an inductorium would be unbearable, and hot.



If it is desired to make an upright, portable apparatus, it may be fashioned after the pattern shown in the cut on page 254, with the jars in the base and the standard and crown above, and all placed on wheels. In this case the cost will be much greater, and it may be purchased cheaper than made. In such an apparatus, if it is desired to place vertical beside the static, instead of horizontal, above, the dimensions will be 9 inches in di-

ameter, and 28 inches in height, with 14 turns of No. 8 wire for the solenoid part and 182 turns of No. 20 wire, in the resonator part, with the other details of construction just the same as for the other.

If economy of space, and efficiency are desired you may make your own apparatus, and this simple and inexpensive apparatus, as devised by the author will give service and satisfaction, rather than a more elaborate and expensive one.

The cut on page 255 shows still another form of portable Tesla high frequency apparatus, which contains condensers, a solenoid-resonator, with interrupter and muffled spark-gap. This may be operated with either a static or X-ray coil generator, and will, with a static, deliver an effleuve of from 12 to 18 inches. Several patients may be treated at the same time with this apparatus, and when in active operation will soon surcharge the air in a room with nascent ozone, which may be used as in an inhalatorium. The discharge from this apparatus makes a wonderfully impressive appearance, when operated in a dark room.

How are high frequency modes measured?

They are hard to measure and then only approximately, by means of a faulty thermostat called a "hot wire meter." The mode heats a wire, causing it to expand and deflect a needle indicator.

What are the effects of high frequency modes?

The physiologic action of these modes varies with the mode used, and it is almost entirely catalytic, except the fulguration, which is a cautery. All these modes will cause hyperæmia, which increases leucocytosis, phagocytosis, absorption, and they also have analgesic, and even anesthetic effects. They improve glandular activity, stimulate oxidation, elimination, and retrograde metamorphosis. They have both a superficial and deep effect on the tissues. They are specially good in auto-intoxication.

What is the effect of the Morton mode?

This is not a high frequency mode in the full sense. It is a wave or vibratory mode which is distinctly felt. The hair stands erect and there is a feeling of exhilaration, stimulation and well being. It is a static mode.

What is the effect of the d'Arsonval mode?

This markedly affects tissue metabolism, but when electrodes are on the skin there is no sensation. It may be applied with the glass vacuum tubes.

It stimulates the glands, raises temperature, aids oxidation, lowers blood pressure, increases elimination and secretion, and soothes the nerves. It may be produced by either a static or coil generator. This mode will not contract muscles, unless a spark-gap is placed in the patient's circuit.

What is the effect of the Tesla mode?

It has little effect on general metabolism. It causes hyperæmia, and analgesia, and can be used with the glass vacuum tubes. It usually is a coil generated mode.

What effect has the Oudin mode?

This causes hyperæmia, increases oxygenation of the blood, oxidation of effete matter, elimination, secretion, absorption of exudates, and formation of carbonic acid. Warms without raising temperature, and is a local analgesic, anæsthetic, antiseptic and germicide. While the effects are more apparent locally, the general system is effected, especially with long treatments. It is most often applied with the glass vacuum electrodes and sparks to the spine. Will increase arterial tension. Very strong sparks have a drying and even a caustic effect, known as fulguration. Prolonged applications will produce annoying superficial blisters or even burns. The red or rose-pink color of the tube indicates a low vacuum, and produces the most heat, is soothing, and most useful in acute and painful, and inflammatory conditions.

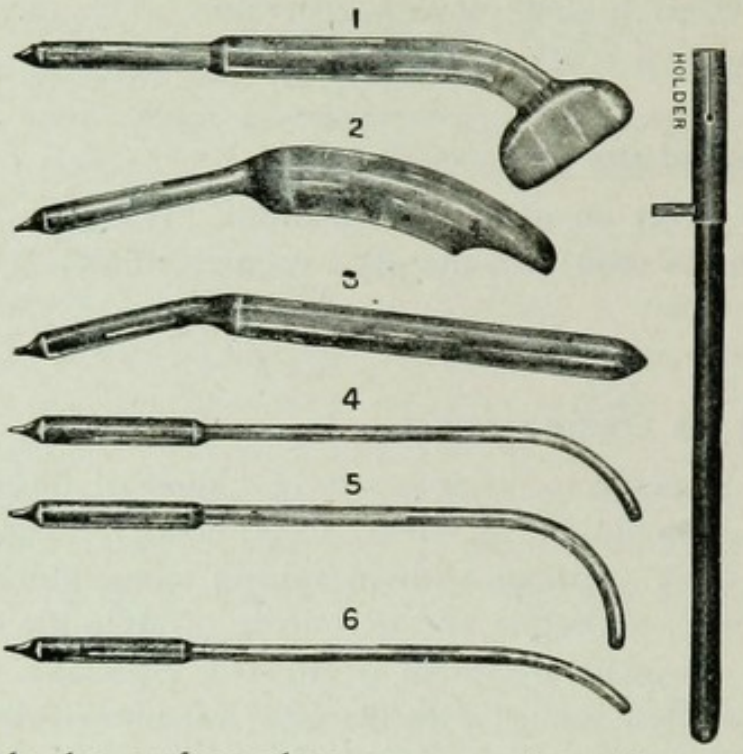
ULTRA-VIOLET-RAY VACUUM ELECTRODES

What are vacuum electrodes?

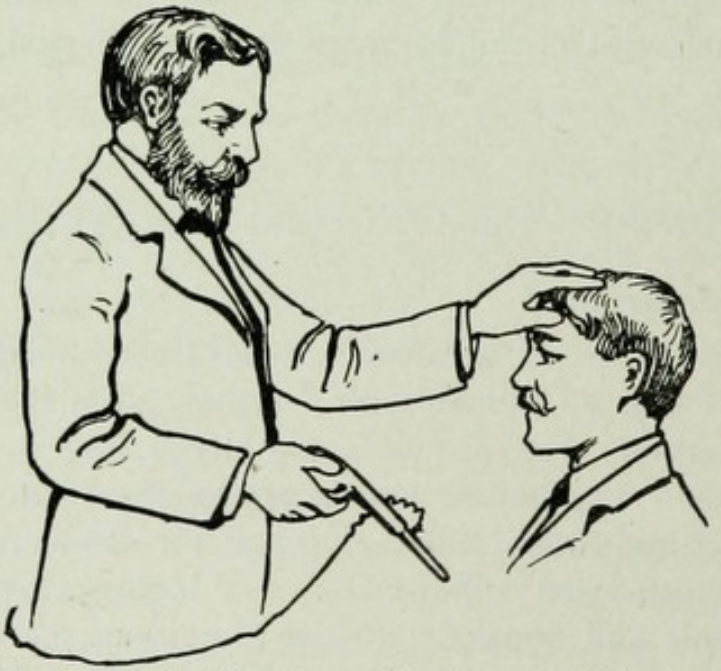
The cut shows a set of six, at about one-third actual size. Fig. 1, for external treatments. Fig. 2, vaginal, with concavity to fit the cervix. Fig. 3, rectal. Fig. 4, urethral. Fig. 5, fauces and larynx, Fig. 6, flat, for nasal and post-nasal region. The handle shown at the right fits all the tubes, and is of hard rubber and brass, with connection for conducting cord.

The blue or bluish-violet tubes indicate a higher vacuum, and are more useful in chronic and impaird nutritive conditions, lack of tone, and sluggish circulation, as in old sores. The violet or violet white tubes have the highest vacuum, and are better adapted to skin diseases, and bacterial conditions, as there are some ultra-violet rays emitted. The white colored tubes have the very highest vacuum, and give off chemical and some X-rays, and are best for malignant growths.

The sketch shows the technique of the single-pole treatment of frontal and supra-orbital neuralgia by means of the high frequency mode. Here



the operator holds the surface glass vacuum electrode, or applicator in his hand, and the mode passes through his body and is then applied to the

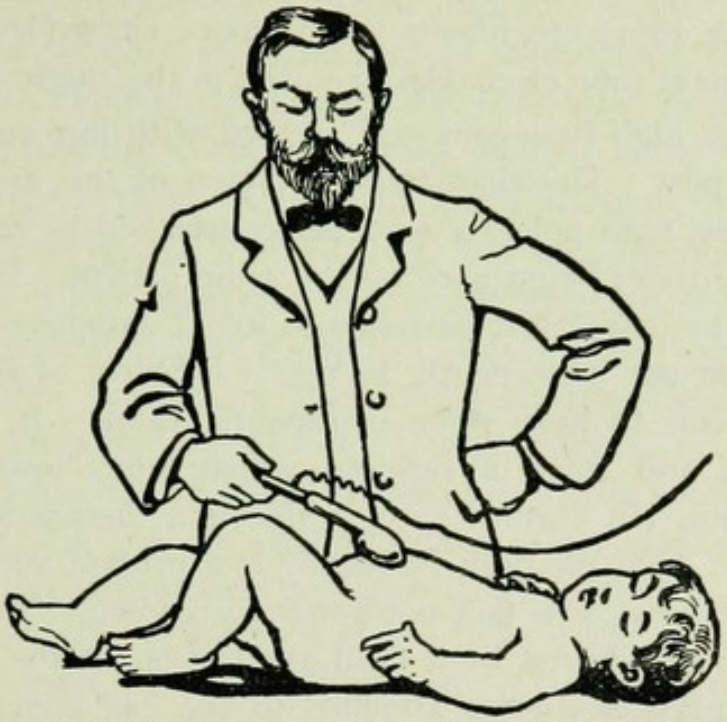


The "Electric Hand" Application of High Frequency.

patient who is either insulated or grounded, according to the effect desired, as shown above.

This is a very simple yet effective method of treatment, and gives

good resuits, and has a profound psychic effect in addition, although the effects will be secured without any suggestion.



Application of High Frequency for Stomach or Bowel Troubles.

The sketch above shows the method of applying the surface electrode to the abdomen of the infant, where suggestion would not avail. This form of treatment is to be recommended in the sluggish conditions found in infants and small children, requiring muscular stimulation.

HIGH FREQUENCY SUMMARY

What are the methods of high frequency treatment?

The methods of administering the high frequency treatment are: by auto-induction, auto-condensation, resonator, two-pole and single pole.

AUTO-INDUCTION. The part is surrounded by a coil of wire through which is passed the high-frequency mode. The body being soaked in the rapidly fluctuating electro-static field, which sets every corpuscle of the body in vibration.

AUTO-CONDENSATION. Patient reclines on a couch over a large metal plate, placed beneath, and connected to one pole, the other applied directly to the patient.

RESONATOR-TREATMENT. In this a coil is connected to one pole of the apparatus with a spark gap in series. The electrode is attached to a

cord connected to a slide contact, which moves over the coil, similar to wire rheostat. This regulates the mode used.

Two-Pole Method. One pole is attached to any ordinary electrode in contact with the patient, the other pole is applied directly to the part to be treated. In the above treatments the ordinary electrodes are used while the low vacuum glass tube electrodes are used in the single pole application.

Ordinarily the high-frequency coil is used with but one cord attached to either binding-post. The characteristic action of this application can be intensified by using both poles, a cord being attached to each binding-post and two glass-electrodes being used on the same patient. If the application is made in this way, care must be taken to avoid cutaneous irritation. Intense local reaction not infrequently follows. In cases of skin-troubles this local irritation seems to have some therapeutic value. It alters the pathological condition and starts a reaction which tends towards restoration of the normal state. In chronic eczema this is a therapeutic indication of some importance. That the high-frequency is a prompt and effective agent for the relief of pruitus, is a fact not generally known. The itching of eczema can usually be relieved by a mild application of the high-frequency. The use of two glass-electrodes attached to the coil enables the operator frequently to treat two patients at one time.

A bi-polar application of a high-frequency mode localizes the effect between the two electrodes. Considering the affinity of high-frequency energy for oxygen, we can readily see the value of a bi-polar application in cases of tuberculosis of the apex, one electrode being placed anteriorly, the other on the back, the infected apex being in the path of the electric discharge.

Single Pole Method. This is the one most used. The patient is placed on the platform, as in simple static insulation, with the bare feet on the foot plate, which is connected to one pole. The other pole is attached to the vacuum electrode and applied to the body. This is only a modification of the two-pole-method.

The Simplest Way, however, is to place patient on platform, not connected with either pole. Then attach the vacuum electrode to the positive pole, and ground the negative. Close the spark-gap. Approach to the part to be treated with the vacuum electrode, and either touch it lightly, or hold it a short distance from the skin. Then gradually open the spark-gap, till you get the desired effect.

There is much ado made about the use of the coil, and it may be nec-

essary in the first four named methods, for using the high-frequency but we know from many experiments, that in order to generate the ultra-violet rays, and use the vacuum electrodes, according to the single pole method, *the coil is not necessary*. With the proper static machine, and the proper technique, the effects can be obtained with much more ease, safety, and simplicity, and a great deal less expense, than with the condenser and coil. The more simple the apparatus the easier to operate, and the better the result. In our experiments we use a twenty-four plate, static machine, thoroughly dry and clean, run as fast as is safe, by a 1-3 H.P. 220 volt, direct, series, motor and speed controller. Close spark gap between sliding rods of prime conductors. *Remove Jars,* Ground negative pole. Connect glass vacuum electrode to positive pole. Put patient on insulated platform. Bare the part to be treated. Place electrode in position (either internal or external). Start machine. When speeded up enough, then slowly open spark gap between the sliding rods, till you get the desired effect. The glass vacuum electrode when not in contact with patient will glow slightly bluish. Placed in contact with skin or near to it, it glows a bright deep violet, and a shower of fine violet rays flow from electrode to patient. The best distance is about an eighth of an inch away. With the tube in contact a slight warmth is felt. When attached to the positive pole the distal end is most violet, and the proximal end shows a greenish fluorescence. With the negative pole, the proximal end is most violet, and the distal end shows the greenish fluorescence. The positive pole, applied to the inside of the wrist, produces tonic spasm of the flexor muscles, and is most felt in the forearm. The negative pole, applied to the wrist, is most felt in the hand. Applied to the forehead with very short spark gap, either pole causes much drawing and a stinging pain, even with the hand placed between electrode and skin. This application caused intense frontal headache for several hours, so much care must be used in applying to the head, or over superficial nerves. Negative pole applied to nasal mucous membrane caused stinging, and pain in upper teeth, with sneezing and increased secretion. Positive pole to nasal membrane, produced no pain or sneezing, but in a few minutes there was the same sensation as if the nose had been sprayed with cocaine. The secretion stopped and congestion disappeared. There was a strong smell of ozone, The same experiments made with one and both jars on, and with one jar grounded and electrode connected to other jar, produced same effect, but very much less marked. Same tests made off the platform were not satisfactory. The tests applied to the skin produced slight redness only. The violet spray from negative pole was much more disagreeable. The too fre-

quent use of the rays will cause intense conjunctivitis and irritation of the eyes. Several positive treatments were given an old case of psoriasis on the arms, and the patient said it was soothing and made the patches feel more natural. From these experiments we get the following conclusions:

In generating the ultra-violet rays a coil is not necessary.

A good static machine is sufficient. It should be run fast.

The spark gap should be short.

Both jars should be removed.

The positive pole is richer in ozone and violet rays.

The negative pole is richer in X-rays.

The positive pole is sedative, soothing and astringent.

The negative pole is stimulant, irritating and congestive.

The polarity of ultra-violet therapy follows the same laws, as of static, faradic and galvanic electrification.

The deep effects are greatest when electrodes are in contact with skin, or mucous membrane.

The superficial effects are greatest when electrodes are close to, but not touching the skin, or mucous membrane.

Great care should be used in treating on the head, or over superficial nerves, and especial care should be used to keep the rays from striking the eyes, to avoid irritation.

The rays can be applied, by proper electrodes, in the treatment of diseased conditions, through any of the skin or mucous surfaces, or cavities of the body.

In the ultra-violet rays with glass vacuum electrodes, we have a most valuable adjunct to electro-therapeutics.

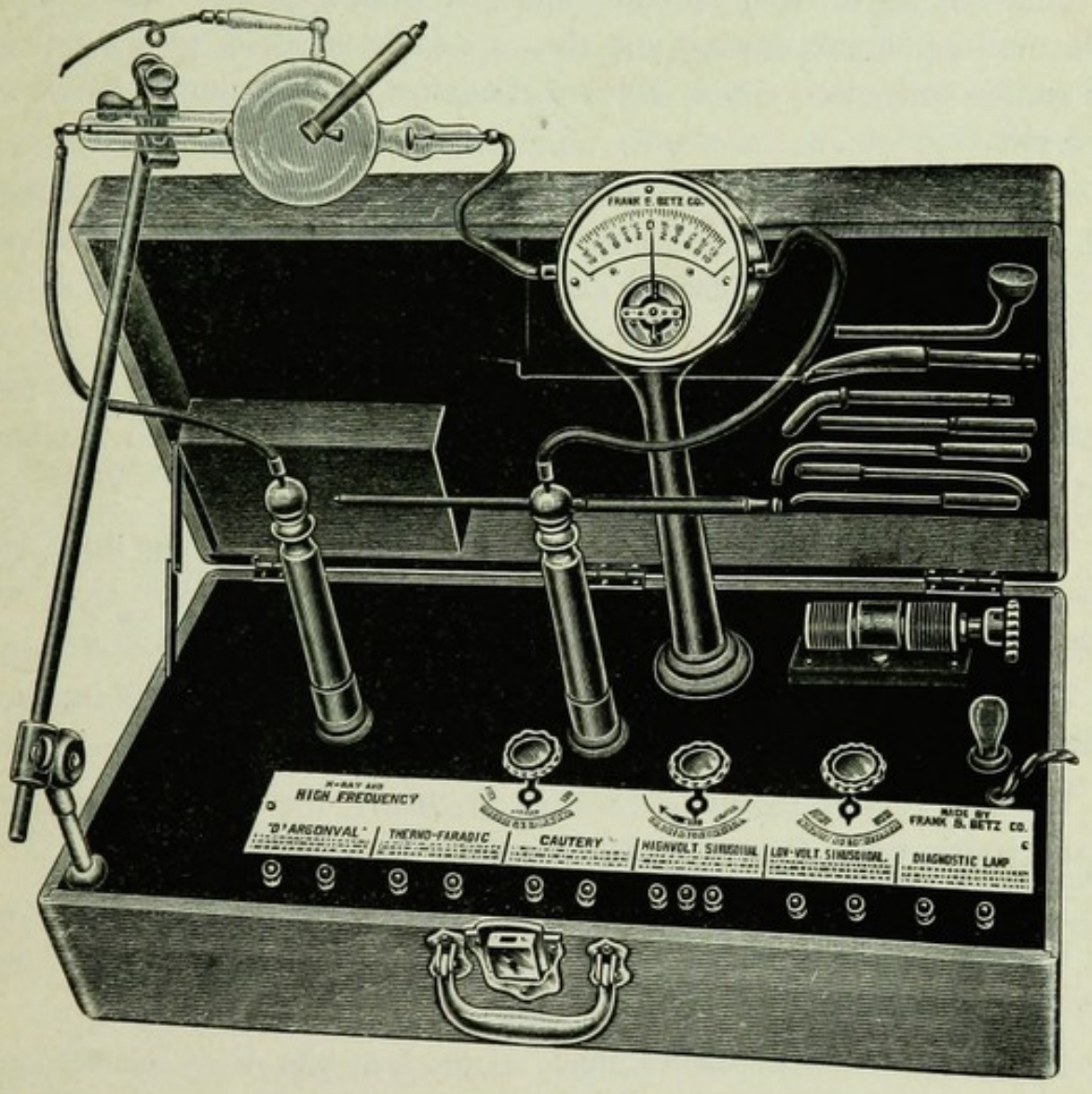
PORTABLE X-RAY AND HIGH FREQUENCY OUTFIT

We show here a new model in X-ray and high frequency portable coil outfits, which has some important improvements, chief of which is the milliamperemeter, which has not as yet been attached to any portable coil.

With this coil fully ninety-five per cent of all ordinary X-ray work may be done, in a satisfactory manner, both therapeutic and radiographic.

In addition to this important feature, it will deliver the following high

frequency modalities: Thermo-faradic, d'Arsonval, Tesla and Oudin, using the ordinary electrodes and the glass vacuum electrodes, from which we may derive the ultra-violet rays. The dermo lamp, which produces the rich actinic rays may also be used with this coil. The auto-condensation, and induction treatments may also be employed.



This outfit also delivers both a high and a low voltage sinusoidal mode, a cautery mode, and another for lighting small lamps for diagnostic and trans-illumination purposes.

All these and other combinations are derived from this portable outfit, by simply connecting the plug to the ordinary lamp socket of the alternated lighting service.

The addition of the milliamperemeter, which shows how much of the mode is passing through the X-ray tubes and the other electrodes, is a new departure and a great advance toward the goal of accuracy in treatment, and uniformity in results.

Electro-therapy is emerging from the realm of guesswork into that of knowledge, which is so essential to success.

The coils are all well insulated and guaranteed against "short circuit," "burn out" or "break down," and they are built in series with a powerful four section condenser, which is guarded against over-heating by a self-cooling device.

All the various modes are easily selected, controlled and regulated by knob switches and calibrated scales, printed in large type so as to be easily read at a glance, and any change may be made easily and quickly, as occasion may require.

The tube holder is adjustable to any position or angle for X-ray, radiographic or therapeutic treatments, by placing the apparatus on a table or chair near the patient.

The meter is mounted on an insulated swivel fork, and has three scales registering from 0—10, 0—100, 0—1000, and is always in plain sight when needed, and can be quickly removed and packed away when not in use.

The primary regulator for the high voltage mode is divided into seven sections, and controls the mode from 0 up to 500,000 volts.

The low voltage regulator controls gradually, the mode for sinusoidal and diagnostic work, from 0 up to 110 volts.

There is a small safety or pilot lamp always in plain view of the operator while at work, which also serves to illuminate the switch-board when working in the dark.

The case is 25x14x7 inches, made of the best kiln dried quarter sawed oak, with a strong carrying handle, and weighs about 60 pounds, with room in the lid to put the accessories except the X-ray tube and meter. It may be taken to the hospital or the patient's home or hotel, and operated wherever there is the alternated light service installed.

The full page drawing on page 266 shows the scheme of the construction and wiring in detail, with the various coils in the center, and the therapeutic uses shown to the right, with the numbers corresponding to

those on the switchboard shown in lower left hand corner, while the wave lines in the left hand column show the various modalities.

In the left hand column at the top we see the sine curve which represents the usual form of sinusoidal alternating mode, derived from the primary street service which is the 110 volt, 60 cycle form. Just below it we see the same curve illustrating the same mode after passing through the transformer, which changes it to a secondary sinusoidal, which has been stepped up to a mode of 15,000 volts, but with the same 60 cycles. The low voltage sinusoidal being a powerful, though painless, muscular stimulant, very useful in such relaxed conditions as we find in prolapsus, subinvolution, constipation, etc. The high voltage sinusoidal in addition having decided analgesic properties, and useful in dysmenorrhœa, ovaritis and nervous conditions of the spine and pelvic organs.

The three other curves show the oscillatory modes of the thermo-faradic having a high amperage and voltage, running up to 15,000 volts, and a periodicity of from 200 to 1000 per second.

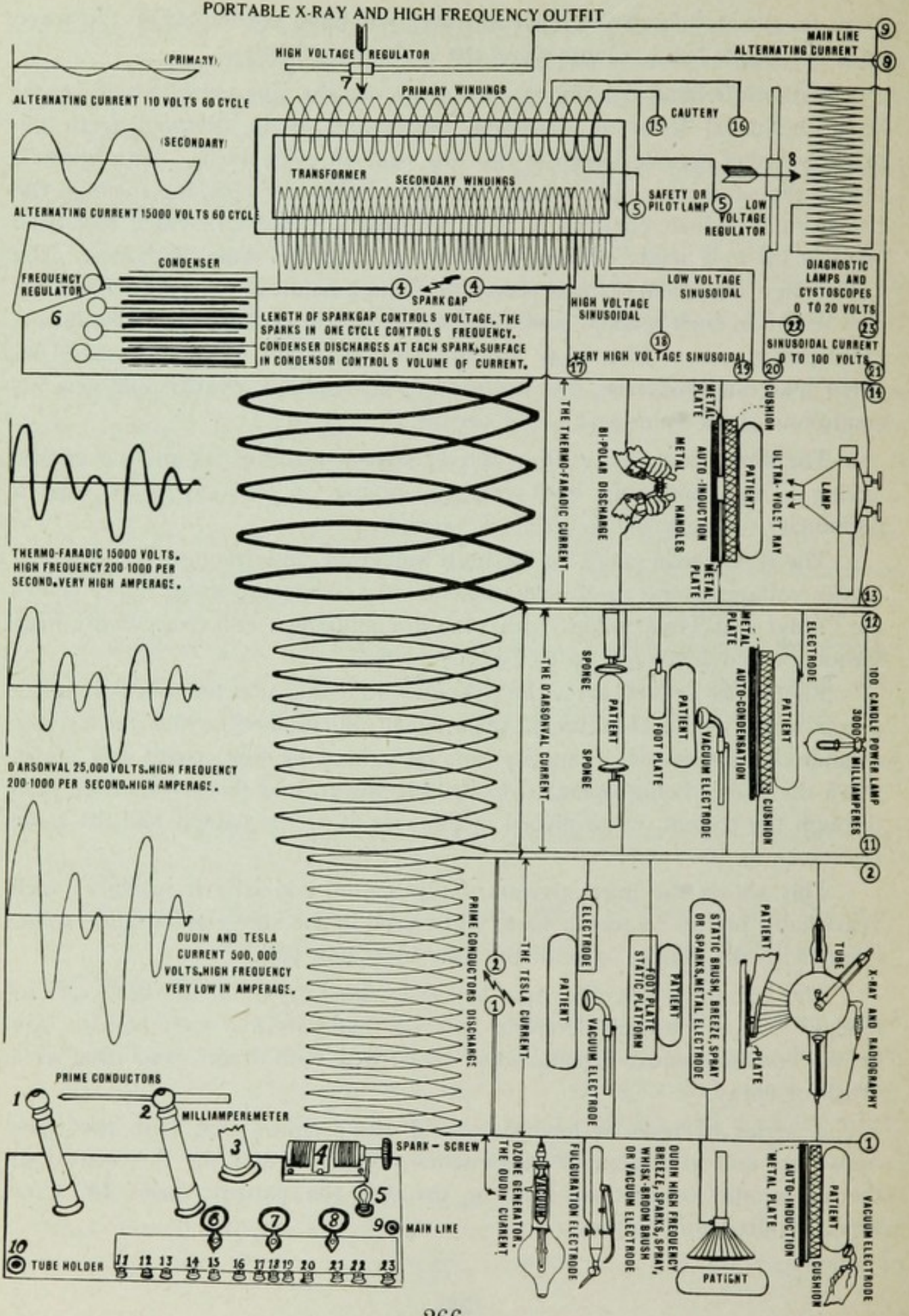
The d'Arsonval mode has a high amperage and frequency and a still higher voltage, going up to some 25,000 volts, while the lower curve shows the Oudin and Tesla modes with very low amperage and exceedingly high frequency and a voltage up to 500,000 volts.

Figures 11 and 12, show the d'Arsonval mode connected to a 100 candle power lamp, with a capacity of some 3,000 milliamperes, which means that a lamp of this size and capacity can be lighted by this circuit and mode, when the coil is being operated to its full power, and this dose would pass through the patient, when placed in this circuit, if the patient had the same resistance as the lamp.

This shows the great power of this mode, and why it produces such remarkable effects on metabolism, when used in the auto-condensation treatment, with the couch, or with the auto-induction pad.

The vacuum electrodes may be used with any or all of these various modes. A very useful electrode may be made from a split bamboo fan or the common whist broom, when moistened with water, and used as a brush or spray.

A series of tests in laboratory and clinic shows that with the same apparatus and arrangement of switches the dose from the d'Arsonval or thermo-faradic connections passing through the patient varies by some three hundred milliamperes.


PORTABLE X-RAY AND HIGH FREQUENCY OUTFIT
(PRIMARY)
ALTERNATING CURRENT 110 VOLTS 60 CYCLE
(SECONDARY)
ALTERNATING CURRENT 15000 VOLTS 60 CYCLE
HIGH VOLTAGE REGULATOR
PRIMARY WINDINGS
MAIN LINE ALTERNATING CURRENT
CAUTERY
TRANSFORMER
SECONDARY WINDINGS
SAFETY OR PILOT LAMP
LOW VOLTAGE REGULATOR
CONDENSER
FREQUENCY REGULATOR
SPARK GAP
LENGTH OF SPARKGAP CONTROLS VOLTAGE, THE SPARKS IN ONE CYCLE CONTROLS FREQUENCY. CONDENSER DISCHARGES AT EACH SPARK, SURFACE IN CONDENSOR CONTROLS VOLUME OF CURRENT.
LOW VOLTAGE SINUSOIDAL
HIGH VOLTAGE SINUSOIDAL
VERY HIGH VOLTAGE SINUSOIDAL
DIAGNOSTIC LAMPS AND CYSTOSCOPES 0 TO 20 VOLTS
SINUSOIDAL CURRENT 0 TO 100 VOLTS
THERMO-FARADIC 15000 VOLTS. HIGH FREQUENCY 200 1000 PER SECOND. VERY HIGH AMPERAGE.
THE THERMO-FARADIC CURRENT
BI-POLAR DISCHARGE
METAL PLATE
AUTO-INDUCTION
METAL HANDLES
PATIENT
CUSHION
ULTRA-VIOLET RAY
LAMP
D'ARSONVAL 25,000 VOLTS. HIGH FREQUENCY 200-1000 PER SECOND. HIGH AMPERAGE.
THE D'ARSONVAL CURRENT
SPONGE
FOOT PLATE
VACUUM ELECTRODE
AUTO-CONDENSATION
ELECTRODE
100 CANDLE POWER LAMP 3000 MILLIAMPERES
OUDIN AND TESLA CURRENT 500,000 VOLTS. HIGH FREQUENCY VERY LOW IN AMPERAGE.
PRIME CONDUCTORS DISCHARGE
THE TESLA CURRENT
STATIC BRUSH, BREEZE, SPRAY OR SPARKS, METAL ELECTRODE
STATIC PLATFORM
PLATE
TUBE
X-RAY AND RADIOGRAPHY
PRIME CONDUCTORS
MILLIAMPEREMETER
SPARK - SCREW
MAIN LINE
TUBE HOLDER
OZONE GENERATOR. THE OUDIN CURRENT
FULGURATION ELECTRODE
OUDIN HIGH FREQUENCY BREEZE, SPARKS, SPRAY, WHISK-BROOM BRUSH OR VACUUM ELECTRODE
PATIENT
AUTO-INDUCTION METAL PLATE
VACUUM ELECTRODE

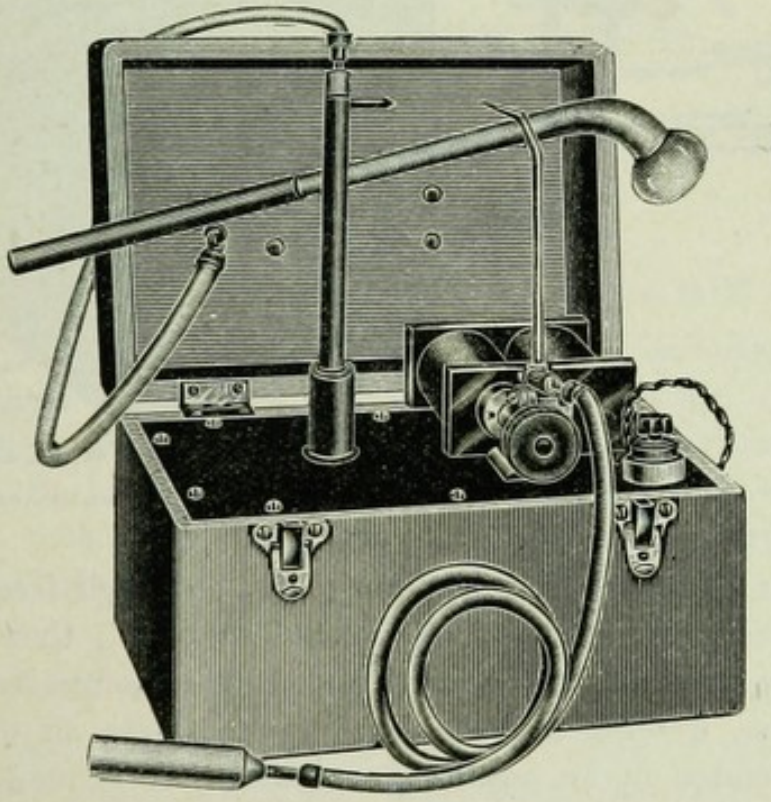
In one coil tested, a patient took but 500 m. a. and another nearly 800, adjustment of coil being exactly the same.

To secure uniform and accurate dosage with the same, or different subjects you see how necessary it is that the dose should be measured by a meter.

You see the advantage of certainty over guess-work in using these modes of appreciable volume and the value of a meter will appeal to you.

The full page drawing on page 266, if carefully studied, will give a full understanding of the various coils and circuits, and by comparing the figures with the corresponding numbers on the plate of the apparatus, the operator will have no trouble in selecting and applying the different modes in his diagnostic, cautery, X-ray and therapeutic work.

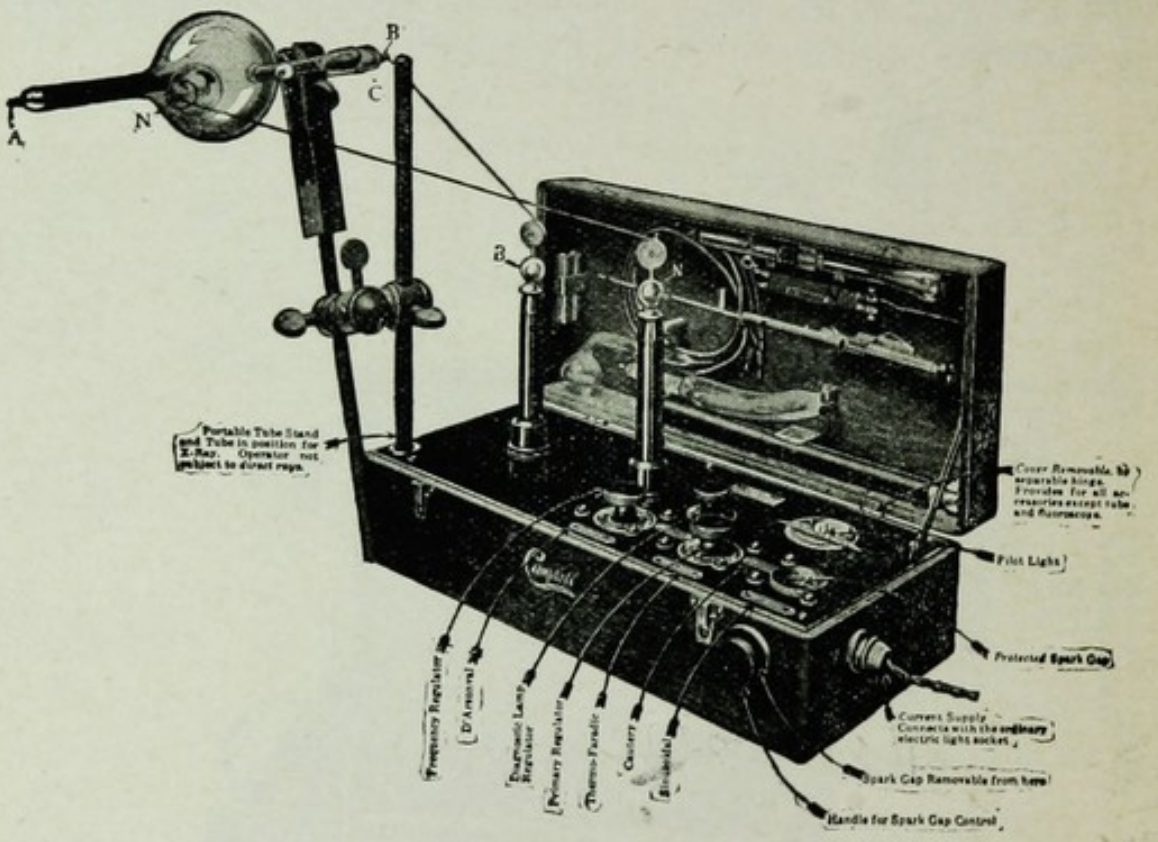
HIGH FREQUENCY OUTFIT



The general utility and increasing demand for the high frequency and X-ray has necessitated portable apparatus, two of which are shown. The smaller one has a double coil, and will throw a five inch spark and weighs only eighteen pounds. The larger one is about the size and shape of an ordinary suit case being 25x13x7 inches, and weighs 85 pounds. It has a

double coil and will throw a heavy six inch spark. These portable outfits are so arranged as to be connected to the ordinary lamp socket and may be operated from any direct or alternated electric light service. They can be depended on for all ordinary X-ray work, but are not as rapid as the large stationary coils. They will do any high frequency work, and their convenience, low cost, and light weight, makes them valuable for certain work.

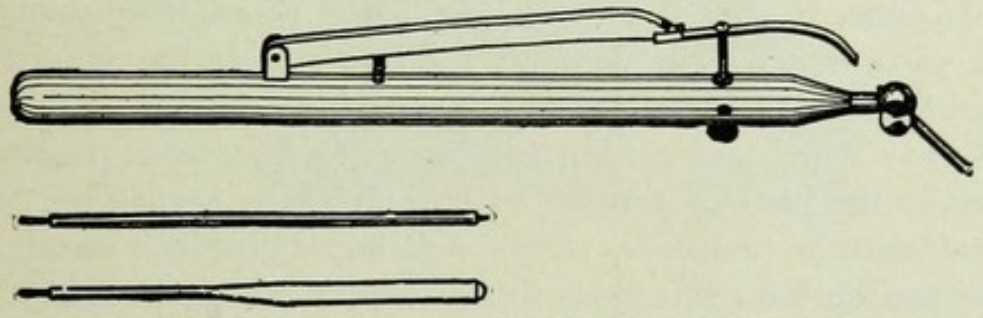
CAMPBELL MODEL "E" PORTABLE X-RAY AND HIGH FREQUENCY COIL



This shows a combination portable X-ray and high frequency coil, giving in addition to the X-ray mode, the d'Arsonval, thermo-faradic, sinusoidal, cautery, and diagnostic service. It is compact, strong, well-made, handsome, durable and efficient, and answers all the purposes for which it is intended in an admirable manner. It is made for either the alternating or direct service, and is ready for use when simply attached to the ordinary lamp socket. Complete set of attachments go with it and are conveniently arranged in the lid, so that it is a multum-in-parvo. It is all self contained except of course the X-ray tube which goes in a separate carrying case, with the glass vacuum electrodes. When mounted on a cabinet it makes a nice office outfit as well as for outside work.

What is fulguration?

The effect in and on the tissues of the concentration for a time on one point, of the high frequency spark, which causes a drying, dessication and even charring of the surface. The effect is but superficial. It is used for the removal of small growths, and will check bleeding. The spark should be about one sixteenth of an inch, and free from heat. On the face a local anesthetic may be used, but if carefully applied, it is not painful. Repeated applications are required till the growth is removed. Several days should elapse between treatments. The surface will dry and turn black, and peel off. If too severe application is made, there will form small granulating sores. Mild treatments repeated p. r. n. are best, and leave no scars. Longer and heavier sparks, and prolonged treatments, under general anesthesia, have proven effectual in removing the remains of malignant growths, post operation. In some inoperable cases, it has given great relief, and even curative.



FULGURATION POINT ELECTRODE

For use with any coil or resonator. For the treatment of moles and warts the fulguration point electrode is attached to the machine, and a tiny spark is drawn from the patient, encircling with this spark the growth to be eradicated, thus cauterizing the growth, so to speak, and cutting off its blood supply, with the frequent result that moles or warts are removed in one or two sittings.

What are the results of fulguration?

Vaso-constrictive and anti-hemorrhagic. Profuse serous exudate. Necrosis may follow excessive dosage. With mild treatment there is a scab or scale which drops off leaving a pink surface. With heavy treatment there is a slough separation and a granulated surface. There is some anesthetic following. A short mild treatment, will first sting, then a white wheal will form, like that following a bee sting. This fades, and a zone of hyperemia appears which soon disappears.

In treating in cavities, an insulated electrode should be used to localize the effect. Fulguration should be used only on a small area at one time. In some cases it will be better and safer than the X-ray or radium, both pre-and post operative, in cancer, as the effect can be localized.

RŒNTGEN OR X-RAYS

What are Rœntgen rays?

Rœntgen rays are so named after the man who first put them to a practical use, and are usually called the X-rays, on account of their formerly unknown classification.

The X-rays will cause certain substances to fluoresce, or glow in the duce heat, and therefore belong to the violet end of the spectrum. The X-rays differ materially from the cathode rays, and the ordinary light rays. They travel in straight lines to infinity, and can be neither refracted, reflected, or deflected by a magnet, (as may the cathode rays,) or by some polished metal, or glass, as are the light rays. They do not produce the sensations of either heat or light. They will pass through substances which are opaque to ordinary light, without heating, and at the same time will not pass through such substances as glass, which is transparent to light.

The X-rays will cause certain substances to fluoresce, or glow in the dark, especially the platino-cyanides of barium and potassium, uranium fluoride, and calcium tungstate. They will decompose the sensitive silver salts, producing the same effects as those of light. They have the property of discharging either positively or negatively charged bodies, and as stated before, will penetrate bodies which are ordinarily considered as opaque. The transparency of these bodies to the X-ray is proportional to the atomic weights of the substances. Thus, aluminum is more transparent to the rays than lead, which has a much greater atomic weight, and we may use the lighter metals as a filter to keep back the weaker rays, and allow only the more penetrating rays to pass through.

What are cathode rays and electrons?

Cathode ray is the name applied to the stream of particles known to pass from the negative to the positive electrode inside a vacuum tube, when energized by a mode of high voltage electrification. This stream of infinitessimal particles, constituting the cathode ray, and which are assumed to be the ultimate division of matter, is composed of what are termed electrons, and are estimated to travel at the rate of 70,000 miles per minute.

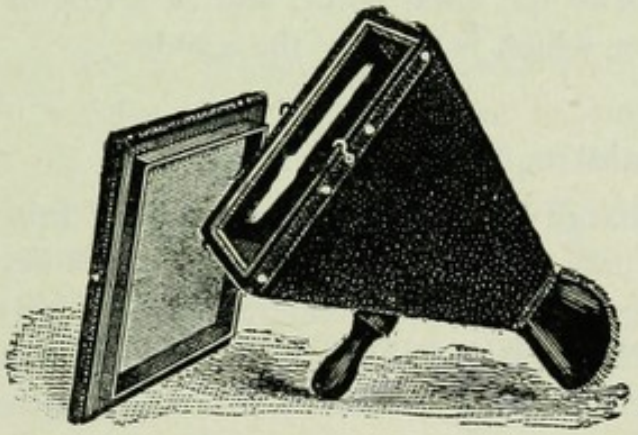
What is meant by the term vacuum?

Vacuum, in electro-physics is that condition of the attenuation of the atmosphere inside of a tube, which is about the one millionth of the density of the outside air, and which is the best condition known for the generation of the X-rays.

What is fluorescence?

Fluorescence is a property possessed by certain crystals of glowing, when acted upon by the X-ray in the absence of light.

What is a fluoroscope, and how used?



A fluoroscope is a funnel or pyramidal shaped metal box, in the base of which is set a screen of some fluorescent chemical, so that the light is excluded, and the shadows of some object intervened between it and the tube will be projected upon the fluorescent screen, and thus become visible to the operator. Inside the box between the screen and operator is a pane of glass which protects the eyes of the observer from injury by the X-ray and emanations from the chemicals on the screen.

What is meant by anode, cathode, anti-cathode, target, focal point?

The anode is the electrode in a vacuum tube to which is connected the positive pole from the electric generator. It is flat, and usually composed of platinum, and is fixed at an angle of 45 degrees to the long axis of the tube, and is usually the target, or point of impact, on which the stream of the cathode rays are concentrated, at what is known as the focal point, by means of a concave disc of aluminum, which constitutes the cathode, which is the electrode to which the negative pole of the electric generator is connected. Sometimes another electrode is inserted inside the tube, opposite the cathode, which is known as the anti-cathode.

How are the X-rays generated?

When the cathodal stream of electrons is focused at a point on the target, they are deflected at right angles and strike the side of the tube, and the X-rays are generated, on the outside of the tube, by the process of induction, and pass straight off into infinity, starting at right angles to the outer surface of the tube.

The divergence of the X-rays equal, in all conditions, in every sixteen inches, 13-16 of an inch. The distortions of fluoroscopic views may be mathematically corrected.

The rays travel in straight lines to infinity, and cannot be deflected, reflected, or refracted, or stopped by ordinary opaque substances. The part of the greatest concentration of the X-rays, or rather the field of strongest activity, is opposite the focal point, and in a line at a 45° angle to the surface of the target which is usually the anode.

When is a tube said to "back up a spark"?

When the discharge refuses to pass through a tube it is said to "back up a spark," which may be two, four, or more inches between the terminals. This is the condition in which we experience a great waste of mode and the possibility of electric burns. When the resistance in the tube is high, and the X-rays intermittent, the liability to these injuries is apparent.

What are X-ray or Crookes tubes?

X-ray tubes are vacuum tubes of various shapes for use in radiography and radio-therapy. They are made in many shapes, some of which are well illustrated and described elsewhere in this book.

TUBE POINTERS

What points should be remembered about X-ray tubes?

Do not short circuit the tube and run continuously, as too much gas will then be driven off. A very few sparks, sometimes one or two, should lower the vacuum sufficiently for the time being.

When the tube cools off after use the vacuum will probably go up again, and may be brought down as in the first instance. A long run may also raise it somewhat.

The best X-ray results depend upon a nice adjustment of the vacuum, for which some tubes are especially designed. If by chance the vacuum

should be lowered too much by using the regulator, prolonged running, or a rest, will raise it again.

We believe that experienced manufacturers of X-ray tubes are now in a position to furnish a proper vacuum and one which will not be materially lowered by use.

The diameter of the plate of a static machine determines greatly the length of the spark. Experience has shown that a plate of thirty inches will excite sufficient length of spark for all purposes. The number of plates determines the quantity and fatness of the spark, and twenty-four plates seems to provide the limit necessity.

When a good tube which has given good service, after a while begins to fail to longer give off the Rœntgen light, it can be restored to usefulness in a few minutes; reverse the discharge through the tube by reversing the connection.

In most instances five to fifteen minutes will restore a tube that has been "worked out." A tube which has too great resistance for X-radiance may be restored to its efficiency by interrupting the negative discharge while properly connected; this will lessen the internal resistance. If the tube is improperly connected, purposely done so for the purpose of reducing resistance, interrupting the positive discharge on its way to the tube will assist the reversed connection in reducing the resistance.

How do you test X-ray tubes?

While the machine is in operation it sometimes occurs that the mode is suddenly reversed, or it may be that the tube is improperly connected. If this is the case with a good tube it will present a green striæ, with very faint nebulæ, together almost filling the tube, or in a higher generating apparatus the cathodal end, including one-third of the tube, is bound with a distinct zone with lighter right angle radiations. Bugs or beads may cling to the tube. This phenomena is quickly dispelled when the mode is properly connected. An improperly connected tube will generate but feeble X-radiance.

The simplest method of testing the penetration of X-ray tubes is to examine the shadow cast on the screen of a fluoroscope.

The density of the shadows seen, determines the degrees of penetration of the X-ray from the different tubes, the tubes being denominated "hard," "medium," or "soft," according to the density of the shadows seen.

The density of the human tissues will also act as filters, so that we will get different degrees of shadows or silhouettes on the photographic

plates and fluorescent screens, and thus distinguish between the flesh, bones, and foreign metallic bodies. This fact is of great importance to us in surgery, enabling us to detect and correct fractures, dislocations and abnormalities of the hard parts, and to diagnose diseased conditions, and to locate foreign bodies of metallic nature. Many lives have thus been saved, and operations simplified, and deformities prevented.

CAUTION:—In the accompanying illustrations—Figs. A, B and C—showing the three hands, bear in mind that these illustrations are only shown to demonstrate the different degrees of penetration with various tubes and generators, and to show the density of different parts. It is not advisable to use the hand often for this purpose, because the effect of the X-ray on the human tissue is cumulative and therefore dangerous, and many operators have lost their hands in the past through ignorance of this fact, and even yet some are careless enough to expose themselves unnecessarily.

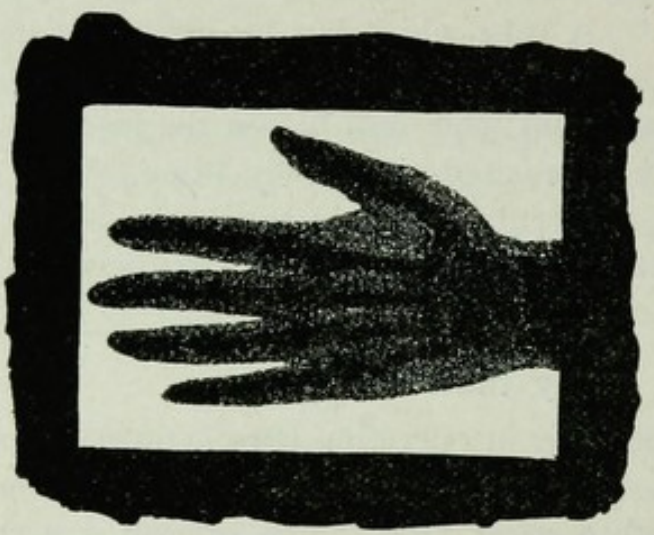


Fig. A. Shadow of hand shown with a soft tube.

When the shadows of the bones of the hand are so dense and black, when seen in the scope, that the joints cannot be distinguished, it shows either a weak mode or that the tube is too soft for good fluoroscopy, or radiography, although a fairly good radiograph will result from a long exposure.

This condition of the tube will be indicated by the cut above, which shows the shadows cast on the scope screen by a very soft tube. The whole hand shows dark, and the bones run together. Such a tube can be used only for superficial treatments, and prolonged exposures at a short distance, may be given with safety.

The condition of a medium tube is shown in the cut (Fig. B), page 275, which shows the shadows cast by a medium vacuum tube. The bones of

the hand and wrist stand out clear and distinct from each other, and the flesh casts a dim shadow. Such a tube can be used for nearly all fluoroscopic work, especially of the extremities, and all but the thickest and densest parts, and for the more extensive and deeper seated diseases, it will be adapted in therapy.

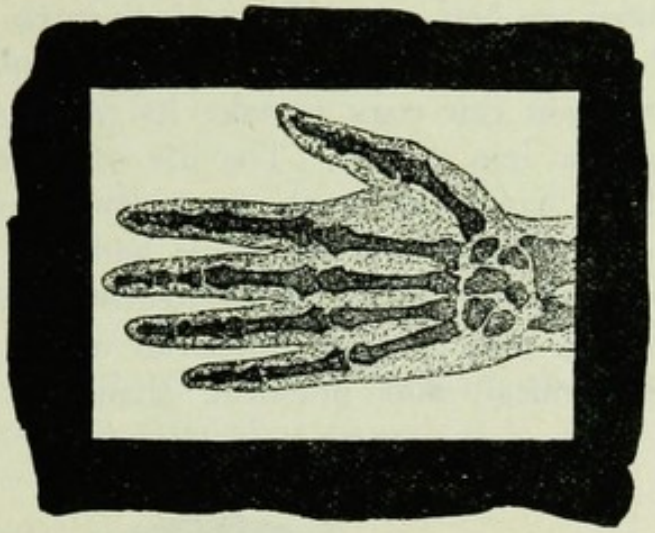


Fig. B. Shadow of a hand shown with a medium tube.

The condition of the hard tube is indicated by the cut (Fig. C), which shows the shadows cast by a hard tube, as seen in the scope. Here the shadow of the flesh is hardly seen, and even the bones cast but a faint shadow, and you notice the texture of the bone, the marrow canal, and the

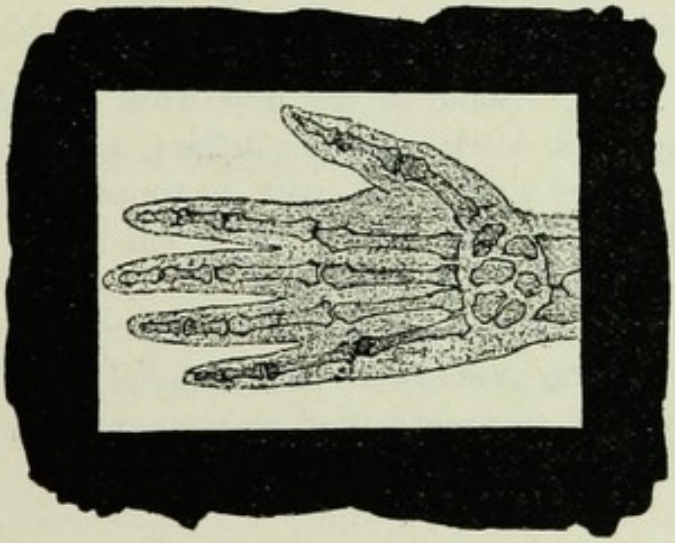
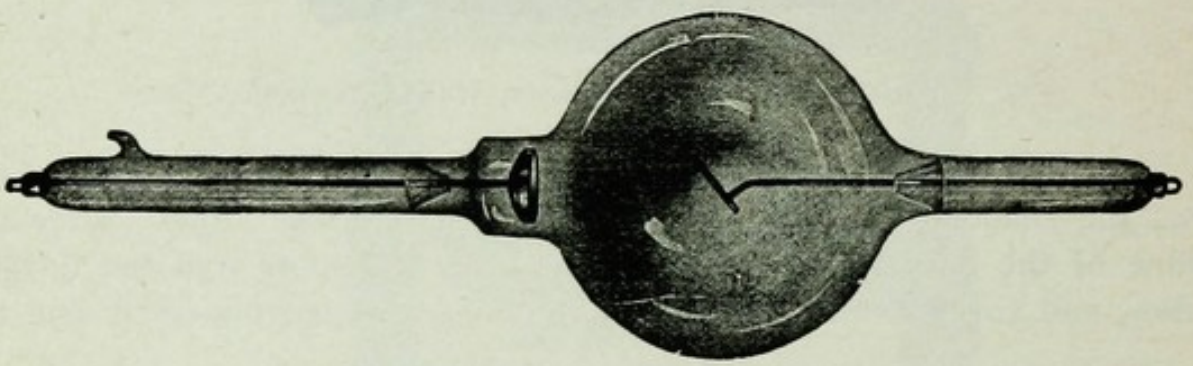


Fig. C. Shadow of a hand shown with a hard tube.

cells in the cancellus parts. Such a tube is best adapted for all deep fluoroscopic examinations, through thick and dense tissues, and for radiographic work in any part. It is not best to use this tube for treatments, as there is

more danger from dermatitis, on account of the penetration and the greater superficial effect. Of course these directions are not arbitrary, because you may be able to so manipulate the various tubes as to get what you desire, in the way of work, from one or two tubes, but for the sake of economy of time, and to get the best results, it is cheaper and better to have several tubes, which you know are best suited for various work. Then if you are unfortunate enough to break or puncture your best tube, you will have another handy, which you can coax to take its place while you get the other repaired, or a new one arrives. The life of a tube will vary with different tubes. I have had tubes break down time after time with little use, with no apparent cause, and then I have had the same tube in use for hours at a time, and for years intermittently, without any trouble. I have found the simple and cheaper American made tubes to be more satisfactory, and economical, and practical, than the complicated and



expensive imported tubes. Some of my best work has been done with a simple non-regulating tube, costing but six dollars, and I have done several hundred dollars worth of cash work with a simple chemical regulating tube costing but twelve dollars. My favorite has stood by me now for about three years, and, with a great deal of use, shows no signs of deterioration. When you get a good tube, stick to it. Learn its habits, as it were, and allow it to work as it seems best adapted, and do not try to do everything with one tool, any more than you would treat every condition with one remedy.

GENERAL DIRECTIONS TO OPERATE AN X-RAY TUBE

All X-ray tubes are carefully tested and must work perfectly before sent out. They are then shipped at owner's risk.

1. Target cap and positive pole.
2. Regulation glass pocket containing chemicals to reduce vacuum.
3. Regulation cap.
4. Anode cap and positive pole.
5. Anti-cathode.
6. Support for target.
7. Target with platinum face and copper support.
8. Cathode.
9. Cathode cap and negative pole.
10. Cathode neck which fits into clamp of tube holder.

Owing to the delicate nature of an X-ray tube, the most important point to be remembered is to handle it with the greatest of care at all times. The slightest jar may dislocate the anode or cathode so that the tube will not focus the rays properly, and the tube would be entirely worthless. When a tube is sent from the factory the vacuum is regulated to about medium, unless otherwise specified, and the majority of tubes are equipped with attachments for raising or lowering the vacuum in the tube to any degree desired.

The weather and temperature has a great deal to do with the condition of an X-ray tube, and, if possible, it should be kept in a dry room at ordinary temperature at all times and as near a uniform temperature

as possible. The tube must be free from moisture and dirt outside of glass when in use.

Tubes of different vacuum are required for different kinds of work. A high tube is used for heavy fluoroscopic work, medium and high tubes for radiography or making radiographs, and a low tube for the treatment of cancers, tumors, etc. Tubes should not be regulated in the vacuum to meet the requirements of all kinds of work, but it is always best to have different tubes, and in this way the same degree of vacuum may be maintained in each one at all times, and it will give much longer service.

How must the tube be connected?

To connect an X-ray tube properly the anode and No. 1 or No. 4 of the tube must be connected to the positive pole of a static machine, or X-ray coil. Then the cathode end No. 9 of the tube is connected to the negative side of a static machine or coil. Some tubes work better to have a wire connecting No. 1 and No. 4; some work better without this wire. Remember, in an X-ray coil the sliding rod with point is the positive, and the sliding rod with disc is on the negative side. When the mode is turned through an X-ray tube, if it makes circles in the lower part of the tube and does not light up the upper portion at all, the polarity is wrong and the cords must be reversed where they attach to the tube. The vacuum of an X-ray tube will become higher as it is used. If a heavy mode is passed through a tube for too long a time, the vacuum will become too low to be used. When the target or anode becomes red, the mode should be shut off and the tube allowed to cool. If it is shut off in time the vacuum of the tube will increase after the tube cools.

The ordinary way of testing the vacuum of a tube is to connect it up to the static machine or X-ray coil and see what the greatest length of spark is that you can get to pass between the sliding rods before the mode passes through the tube. For ordinary work a spark gap of 2 to 5 inches is about right. It is also necessary to consider the general conditions of atmosphere, in making a test in this manner, for the reason that, if the atmosphere is thoroughly dry the mode may pass between the sliding rods much wider than when the atmosphere is moist.

There are different kinds of regulating devices to raise and lower the vacuum of X-ray tubes. In most tubes the tube is connected up so that the electrification passes through a small projecting tube or regulator No. 2 on side, which contains chemicals and when the mode passes through these chemicals a gas is generated, which lowers the vacuum. In other tubes the same result is obtained by connecting the metal cap No. 3 on end

of regulator with metal cap No. 9 on cathode end of tube with a metal rod for a second or more. When the tube lights up properly break the connection with rod quickly, so vacuum is not reduced too much. The vacuum in a plain X-ray tube can be lowered by applying heat to glass bulb. Vacuum in still another style of tube is lowered by removing the cover glass, which protects the platinum tip, and then heat the latter with a small alcohol lamp for a few seconds. Do not allow it to get more than dark red. Do not switch on the mode until this tube has become quite cool again. Although the majority of tubes have special regulating attachments, these sometimes fail to bring the tube to the proper degree of vacuum, and other methods must be applied.

When is a tube too high?

A tube too high can be noted when the mode flashes and sputters inside the tube or sparks pass outside of tube from cords and then the tube lights up for a short time only, instead of throwing a steady ray, and sometimes will not light up at all on account of the great resistance offered the mode inside of the tube, then the vacuum must be lowered.

If, after following instructions, which apply to each tube for using the regulating devices, you fail to reduce the vacuum, then connect the tube up in the regular way to the static machine or coil and take a small alcohol torch or lamp, which will furnish a flame about one inch in diameter. Keep this flame in motion under and around the bulb of the tube, being sure that the heat is evenly distributed for about three minutes. If the tube is connected up properly, you will notice a gradual change in the rays of the tube (at this moment the lamp should be removed) and the bulb of the tube will retain enough heat until the vacuum has been reduced so that it shows a steady green or yellow light over the entire front half of the bulb. If heated too much the vacuum becomes too low and must be raised again before using. Another plan of reducing the vacuum is to put the tube in the oven of an ordinary baking stove at the temperature required for baking bread. Use a pasteboard box with the bottom removed, allow the tube to rest on the edge of the box, leave it in the oven for about five minutes, then allow it to cool; when tested, if the vacuum is still too high, allow it to remain a little longer in the oven next time, and so continue until vacuum reduced.

When is a tube too low?

A tube too low can be noted by a dull blue or purple light inside the tube. Some tubes will show a perfect green ray when connected, but may

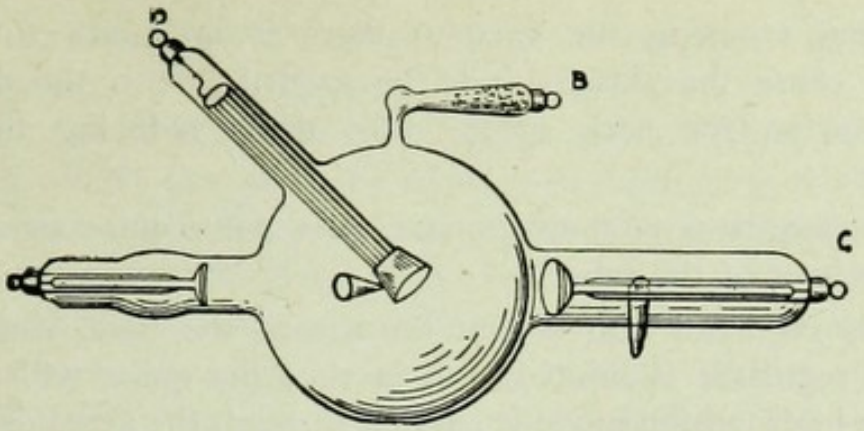
be too low to see the bones of the hand through the fluoroscope. In some cases the fluoroscope is at fault, the screen may be too old or the box may allow light to enter. It should be operated in a dark room. If the vacuum of a tube is too low it can be raised by increasing the spark gap on either the negative or positive pole, and sometimes works best when the spark gap is increased on both the positive and negative pole. A very low tube must be re-exhausted. If the regulating attachments fail to raise the vacuum of a tube, then reverse the polarity of the mode and allow it to pass through the tube in the opposite direction by changing the cord connections to the opposite ends of the tube. After running the tube this way for a period of three to five minutes, then reverse the polarity to the proper direction, and you should notice a decided change in the tube; however, if the vacuum has not raised when first applied, reverse the polarity again and allow it to run a little longer; only a very small amount of mode can be sent through a tube, when the polarity is reversed, otherwise the glass tube becomes black. Several trials may be necessary before the vacuum will raise to a proper degree. The vacuum of a tube can be raised by sending a very heavy mode through the tube for a very short time. The tube must be connected in the right way, and when the anode becomes red turn off the mode and allow the tube to cool. When tested, if the vacuum is still too low, repeat in the same way again, but we have never known these methods to fail when applied to tubes which were not punctured or broken.

When is a tube punctured?

A punctured tube can be noted by bright sparks jumping from the attachments on the inside of the tube when the mode is turned on. On account of not enough mode passing through the tube, sometimes it will make a hissing sound and sparks will light up around the edge of the disk on inside of the tube.

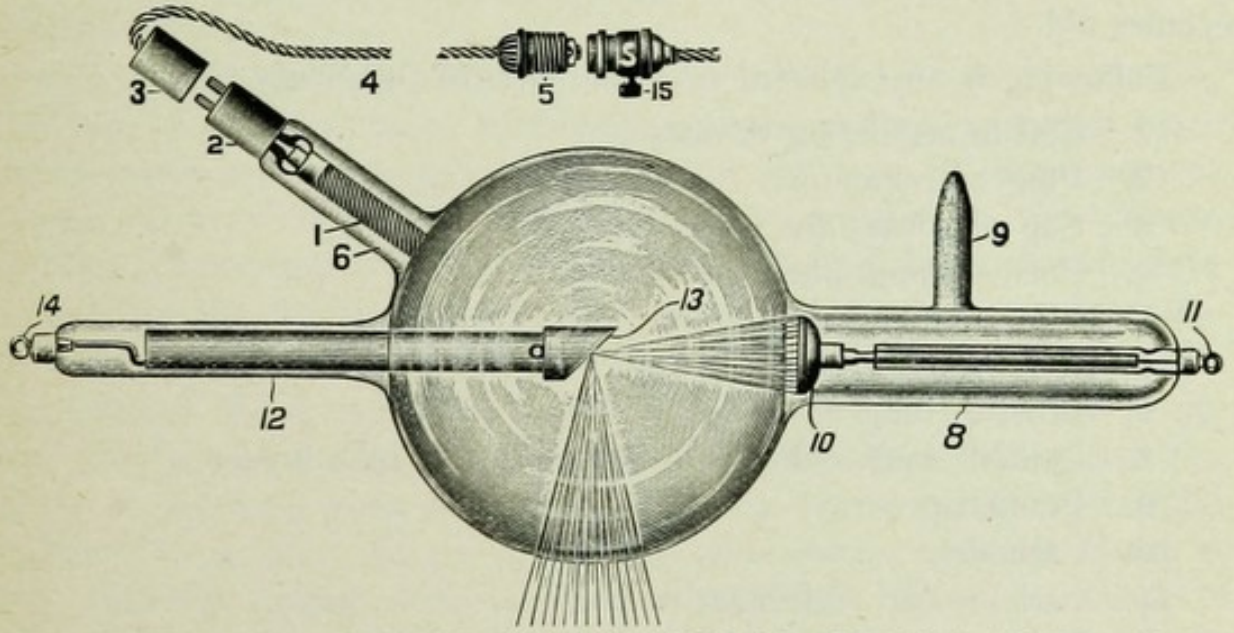
What tube should be used?

When using an X-ray coil, be sure that you have a tube especially designed for coil work. The general line of tubes are made for use on static machines and will not stand the heat which is generated in a tube when being used with a coil. Tubes with special attachments to prevent heating are made for this purpose, and no tubes should be used when anode becomes red or there is danger of burning them out or puncturing them. Coil tubes should have a heavy anode, but any tube can be used if coil is made so it can be regulated to give small enough mode.



BRIEF DIRECTIONS FOR ADJUSTING VACUUM

Most tubes are high in vacuum. Always test your tube first on the A and C terminals, and if the mode will not pass through the tube, or if tube will not show satisfactory illumination, reduce the vacuum by using the regulator as follows: Have your tube connected, ready for use. Then remove wire from cathode end C and attach to regulator end B. Then turn on mode for *one* second only; remove wire from regulator end B and attach again to cathode end C. Test your tube again, and if the vacuum is not yet correct, repeat lowering operation until proper vacuum is secured.



THE GERMAN-AMERICAN ELECTRIC REGULATOR X-RAY TUBE

This new electric regulator has many advantages over all other regulators.

1. The operator can regulate the vacuum of the tube while he is many feet away from the tube, and thus protect himself.

2. When reducing the vacuum there is no spark to frighten the patient and cause the skiagraph to be spoiled. Also the danger of the spark puncturing the neck of the tube while reducing the vacuum is removed.

3. The regulator is simple, and it does not require an expert to regulate the vacuum of the tube.

4. This regulator will outlast the life of the tube, while the life of an asbestos regulator is limited, and in time the gases will cease to generate, as the high-tension mode is passing through the asbestos packing.

5. The mode passing through the regulator is entirely separate from the high-tension mode which lights up the tube, and for this reason it does not interfere with the rays of the tube in any way and does not cause an inverse mode in the tube, which always interferes with the correct timing of the exposure.

6. The inverse mode causes the inside of a tube to become black; this shows plainly in an old tube. The regulator will prevent this condition.

This regulator will change the vacuum of a tube more often, with greater convenience, and with less harm than any other regulator, as there will be no inverse mode and no gases to fail to generate when the tube becomes old.

Following is an explanation of the parts of the X-ray tube:

1. Coil in regulating device.
2. Plug of regulator.
3. Cap of socket for regulator.
4. Cord to lamp plug.
5. Plug to lamp socket.
6. Glass pocket for regulator.
7. Bowl of tube.
8. Cathode neck, which fits into clamp of tube holder.
9. Pump tip.
10. Cathode.
11. Cathode cap and negative pole.
12. Neck of anode of tube.
13. Anode or target.
14. Anode cap and positive pole.
15. Key to lamp socket to turn mode on and off regulator.

When ordering one of these tubes with the German-American Regulator, you should state the kind of mode you have, giving voltage, and if alternating, the number of cycles.

To connect up the regulator, when the tube is connected up to a static machine or X-ray coil, attach the plug end of the cord to the regulator, then screw other end of cord into lamp socket in your office, so the operator at the lamp socket can turn the mode on or off as it is required to regulate the vacuum. When the vacuum of the tube is properly adjusted, the plug can be disconnected from the socket. In case the operator does not have a commercial mode, a regulator can be furnished that can be operated with a few dry cells connected up special. When no mode is specified with the order, the regulator will be furnished for 110 volts, either direct or alternating.

Owing to the delicate nature of an X-ray tube, the most important point to be remembered is to handle it with the greatest of care at all times. The slightest jar may dislocate the anode or cathode so that the tube will not focus the ray properly and the tube would be entirely worthless. When a tube is sent from the factory, the vacuum is regulated to about medium, unless otherwise specified.

The weather and temperature have a great deal to do with the condition of an X-ray tube, and, if possible, it should be kept in a dry room at ordinary temperature at all times and as near a uniform temperature as possible. The tube must be free from moisture and dirt outside of glass when in use.

Tubes of different vacuum are required for different kinds of work. A high tube is used for heavy fluoroscopic work, medium and high tubes for radiography or making radiographs, and a low tube for the treatment of cancers, tumors, etc. Tubes should not be regulated in the vacuum to meet the requirements of all kinds of work, but it is always best to have different tubes and in this way the same degree of vacuum may be maintained in each one at all times, and it will give much longer service.

To connect the X-ray tube: Anode No. 14 must be connected to the positive pole of a static machine or X-ray coil. Then the cathode end No. 11 of the X-ray tube must be connected to the negative side of a static machine or X-ray coil. In an X-ray coil, the sliding rod with point is positive, and the sliding rod with disc is negative. When the mode is turned through an X-ray tube, if it makes circles in the lower part of the tube and does not light up the upper portions at all, the polarity is wrong and the cords must be reversed where they are attached. The vacuum of an X-ray tube will become higher as it is used. If a heavy mode is passed through an X-ray tube for too long a time, it causes the anode to heat and the vacuum will become too low to be used. When the target or anode becomes red, the mode should be shut off and the tube allowed to cool.

If it is shut off in time, the vacuum of the tube will increase after the tube cools.

The ordinary way of testing the vacuum of an X-ray tube is to connect it up to the static machine or X-ray coil and see what the greatest length of spark is that you can get to pass between the sliding rods before the mode passes through the X-ray tube. For ordinary work a spark gap of 2 to 5 inches is about right. It is also necessary to consider the general conditions of atmosphere, in making a test in this manner, for the reason that, if the atmosphere is thoroughly dry, the mode may pass between the sliding rod much wider than when the atmosphere is moist.

A tube too high can be noted when the mode flashes and sputters inside the tube or spark passes outside of tube from cords, and then the tube lights up for a short time only instead of throwing a steady ray, and sometimes will not light up at all on account of the great resistance offered inside of the tube, then the vacuum must be lowered.

To reduce the vacuum of this X-ray tube, turn the mode through the tube from the static machine or X-ray coil, then turn on the commercial mode, either direct or alternating, with key 15, and watch the light constantly, and the instant the tube lights up with a green illumination as it should do, turn the mode off with key 15. In some cases it would require this mode to be turned on one or two seconds, in other cases 10 or 15 seconds, and it should seldom be necessary to turn it longer than 30 seconds.

A tube too low can be noted by a dull blue or purple light inside the tube. Some tubes will show a perfect green ray when connected, but may be too low to see the bones of the hand through the fluoroscope. In some cases the fluoroscope is at fault, the screen may be too old, or the box may allow light to enter. It should be operated in a dark room. If the vacuum of a tube is too low it can be raised by increasing the spark gap on either the negative or positive pole, and sometimes works best when the spark gap is increased on both the positive and negative pole. A very low tube must be re-exhausted.

A punctured tube can be noted by bright sparks jumping from the attachments on the inside of the tube when the mode is turned on. On account of not enough passing through the tube, sometimes it will make a hissing sound and sparks will light up around the edge of the disk on the inside of the tube.

When using an X-ray coil, be sure that you have a tube especially designed for coil work. The general line of tubes are made for use on static machines and will not stand the heat which is generated in a tube

when being used with a coil. Tubes with special attachments to prevent heating are made for this purpose, and no tubes should be used when anode becomes red or there is danger of burning them out or puncturing them. Coil tubes should have a heavy anode, but any tube can be used if coil is made so it can be regulated to give small enough mode.

To operate an X-ray tube from high frequency coils, better results will be obtained by using a tube designed for this kind of a coil. Such tubes are provided with double cathodes, and connections should be made from prime conductors of machine to the cathodes, leaving the anode or target cap unconnected.

Caution. Do not run the mode too long through the regulators and lower the vacuum too much, or overheat the wire.

HOW TO USE AN X-RAY TUBE WITH A CEDERGREN POLE CHANGER

Connect the center ball in the fixtures on each side of machine with the sliding rod at 3 and 4, Fig. 9, using the short rubber covered cords. Connect the X-ray tube with metal buttons marked 1 and 2, as shown in Fig. 9. The anode end of the tube is positive end. The polarity of the tube never changes but the polarity of the machine may change. This can be reversed by sliding the rod H. Fig. 9, so the ball 3 will come in contact with ball 5, see Fig. 9. Also have a spark gap when using an X-ray tube, unless the vacuum is very high; in that case connect the tube direct to prime

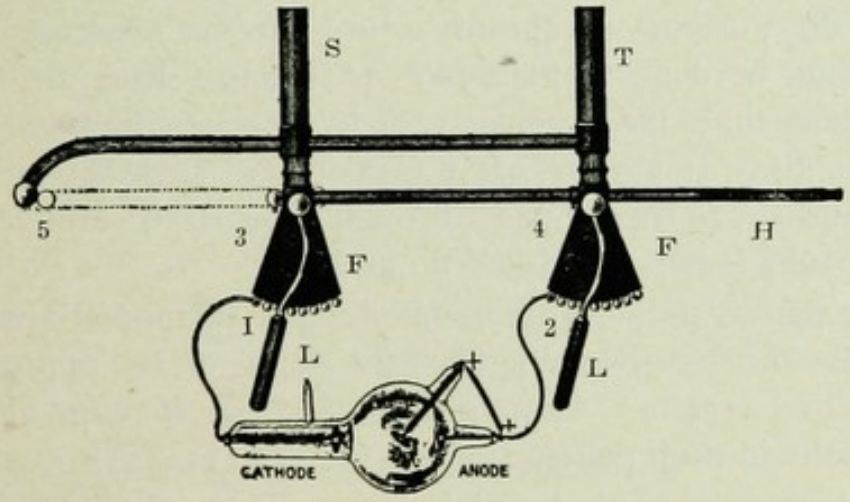


Figure 9.

conductors. If the vacuum of tube is low the spark gap needs to be increased by moving levers L and L one or more buttons so spark will pass from 1 and 2 to L and L. If vacuum of tube is high the spark gap needs to be decreased by moving levers L and L to 1 and 2. When a tube is properly

connected it will be illuminated with a bright green light showing plainly in one-half of the tube. If the green light flickers in the back of the tube and forms circles, the polarity is wrong; the polarity of the mode must be reversed with sliding rod H. Fig. 9, in pole changer. If your tube is too high the mode will not pass through the tube but will escape from cords and off ends of tips. Sparks will jump between cords and brass balls on front of machine. Tube will probably light up at intervals and then give out a hissing noise along cords and points of connections and vacuum of tube must be reduced.

To accomplish this if you have a tube with self-adjusting attachment, follow the directions that accompany the tube. If you have a plain tube a good plan is to put it in the oven of an ordinary baking stove at the temperature required for baking bread. Use a pasteboard box with the bottom removed, allow the tube to rest on the edges of the box, leave it in the oven for about 5 minutes, then allow it to cool and when tested, if the vacuum is still too high, allow it to remain a little longer in the oven next time.

Another plan is to heat the tube over an alcohol or gas flame, keeping the tube moving so the heat will not become too intense in any one spot but will be distributed evenly over the whole surface. There is no danger of breaking the tube by the heat unless you let it get too hot in any one spot or let a cold draft strike it while warm.

If the tube is too low, the tube is illuminated with a purple light, which indicates the vacuum should be raised, which can be done by increasing the spark gap with levers L and L. If tube is still too low, another plan is to reverse the mode and run the positive through the negative end of the tube. This should be done without any spark gap. Run the tube in this manner for a short time, then change back to right position and see if tube is raised sufficiently. If not, repeat the operation as before until desired results are obtained. If sparks pass through tube from cathode and strike the target, your tube is punctured and no good.

When your tube is properly illuminated, place the object about one inch from the tube and the fluoroscope against the object on the opposite side and you get the desired results. As a tube is used the vacuum increases and gives better results in deep penetration.

An X-ray picture is made by placing the X-ray photographic plate in the black envelope, this to be placed in another envelope and sealed. Notice which side of the plate the film is on and have that placed next to the object to be radiographed. Then place the object on the envelope and the tube about eight inches above the object. Turn on the X-rays and an ex-

posure of about a minute or longer, according to intensity of mode will give a satisfactory radiograph.

Do not keep plates and the photography paper in the same room as static machine as the ray will expose them. Keep fluoroscope in dark, cool place.

To treat cancers and other skin diseases, select a tube that is not too high. The patient should be placed in front of tube and from 4 to 8 inches from it. All parts of patient should be protected from the rays except the part treated. This may be done by making a mask of two or three thicknesses of X-ray tin foil and make a hole in it just large enough for the part treated to be exposed. Exposures should be made from 3 to 6 minutes.

Why use multiple spark gaps?

Multiple spark gaps are an advantage, in that the breaking of the mode a number of times while the tube is in circuit, imparts a greater tension, and also gives it an oscillatory character, which greatly increases its generating power. They are usually placed on both sides, with about twice as many on the positive as on the negative side.

What value have pole changers?

Pole changers are an advantage, on account of the easy manipulation of the direction of the mode through the tube, without changing the connections between the tube and generator.

A good attachment to have on the static machine is a pole changer, so that if the tube is connected and the polarity of the machine should change as it will on some of the static machines, then you may reverse the mode through the tube, without disconnecting and re-connecting the tube.

This is also very convenient if the vacuum is too low, and you wish to raise it by merely running the mode through the tube backwards. A good combination of a pole changer and multiple spark gap combined, and which can easily be attached to any make of machine by any one, is shown on page 285.

What is the technique of X-radiography?

The technique of X-radiography is to bring an energized vacuum tube, and object to be radiographed, and a sensitive photographic plate in line, so the part to be graphed will be in direct line with the anodal axis of the tube. The exposure having been made, the plate is developed as an ordinary photographic plate.

How do we compare fluoroscopy with radiography?

The great difference between fluoroscopy and radiography is in the distinctness of the image fixed on the plate, as against the irregular outline and dim shadow seen on the screen. The one is for perfect and accurate record, while the other is for examinations not requiring much exactitude, and often in cases where time is an important factor.

What is the radio-activity of a tube?

The radio-activity of an X-ray tube is dependent upon the source of energy which acts, and also on the degree of vacuum within the tube. A tube with a low vacuum will not generate X-rays of as great penetrative powers as will a tube of higher vacuum, and vice-versa. Therefore a soft tube should be used for treatments requiring but little penetration, and a hard tube employed for the treatment of deeper seated troubles, or when you wish to make a radiograph through the thicker parts of the body.

What is meant by the anodal axis?

The anodal axis of a tube is that part of a tube which generates the strongest rays, or rather that part of the field in which the rays are most concentrated, and this axis is a plane exactly at a 45° angle to the plane of the anode or target, within the tube.

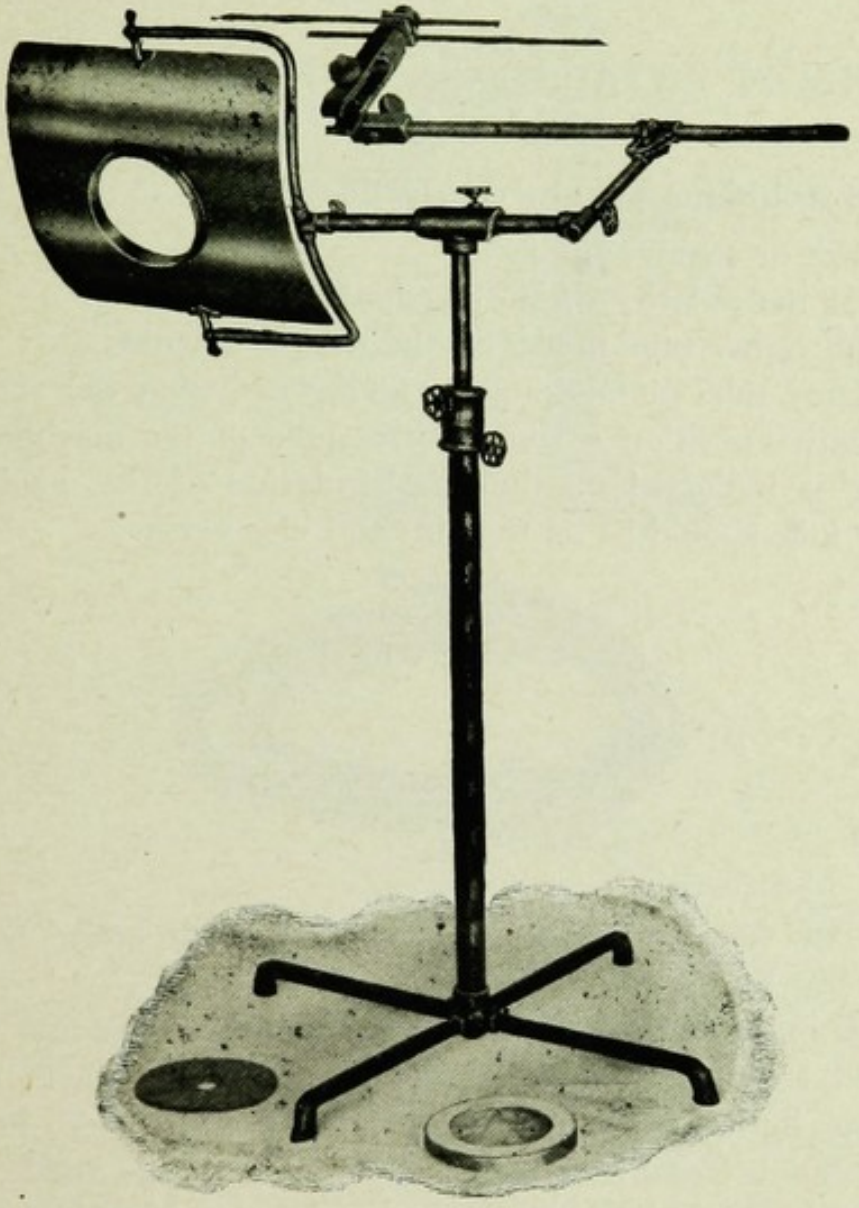
In making either fluoroscopic examinations or taking radiographs this anodal axis should be directly over or in line with the part which it is most desired to examine or radiograph.

Of what value are shields and screens?

In either fluoroscopic or radiographic work there should be much care exercised that you do not expose too much healthy surface to the action of the X-rays, therefore it is always advisable and in fact is very essential, that the operator have some means of protection for the surrounding parts. For this purpose some form of metal shield should be used, which will effectually cut off the rays from all but the field, or part which it is wished to ray.

It is also best for the operator to take precautions for his own safety, so that he will not be influenced by the rays. For this purpose a screen may be used, behind which he may observe the work he is doing, or he may wear an apron of some material which is opaque to the rays. These precautions will greatly add to the safety and satisfaction of the work, and

at the same time possibly save him from troublesome complications, and delays, and annoyances, due to accidental irritations, or dermatitis, or so-called "burns" or from suits for malpractice. A careful operator will not very likely have any such trouble, especially if he takes the precaution to always warn the patient of the possible danger, but it is always best to be on the safe side. Better to be much too careful than a little too careless.



THE ALLEN X-RAY SHIELD AND TUBE HOLDER

The cut above shows a good combination of a tube holder and an adjustable protecting screen, which may be used in any position. The shield is made of aluminum, which is partially opaque to the rays, with a central shield made of sheet lead, which is very opaque to the rays. In the lead a hole may be cut of any desired shape or size, for the purpose of irradiating only

a limited area, while the parts in the immediate vicinity are completely protected from the more powerful rays, and the parts more remote are also protected from the weaker rays by the larger aluminum shield. The stand of a shield should be of metal, to act as a "ground" to carry off the stray static modes or streamers, which may annoy the patient and cause him to move, which would spoil the result if a radiograph was being made.

MANNER OF ATTACHING X-RAY APPARATUS TO THE STATIC MACHINE

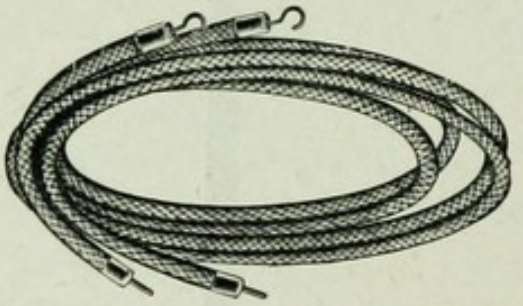
What is the technique of tube connections?

Disconnect or remove the jars.

Ascertain the polarity of the machine.

Place the X-ray tube holder in the desired position.

Affix X-ray tube in tube holder, taking care that the anode will be in the same relative position as the positive pole of the machine, i. e., if the positive pole is indicated on the left hand side of the machine, then the anode of the tube should be on the left, and vice versa.



Connect the heavy insulated X-ray cords to the prime conductor posts and then to the X-ray tube.

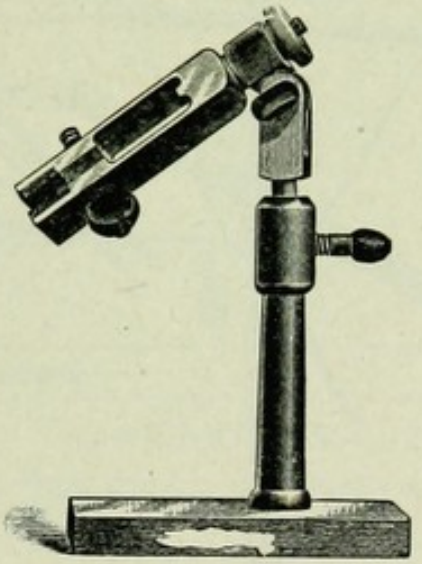
Start the machine with the prime conductors closed and then after the desired speed is attained, pull out the prime conductors their full extent, when a green light should appear, forming a hemisphere in front of the anode. If a number of green rings appear back of the anode, this indicates that the polarity of the machine is reversed and that the tube must be disconnected and reversed, or the mode direction reversed by means of the pole changer.

The X-ray light radiates from the center of the anode outward, therefore focus the point to be examined directly in front of the center of the anode and about six to ten inches from it.

Press the fluoroscope screen close upon the object so as to reduce the length of the shadow.

X-rays penetrate all substances according to their density, consequently bone and metal, having greater density than flesh and blood, will be indicated by a more pronounced shadow.

The shorter the distance from the source of light the more definite will be the shadow indicated on the screen.



THE TUBE HOLDER

What is the tube holder?

The tube holder is a stand arranged to hold the tube while in action. A good stand should have a heavy, firm base to insure stability, an arm that will admit of various positions by the simplest device possible, and it should have a cross bar holding up the conducting cords.

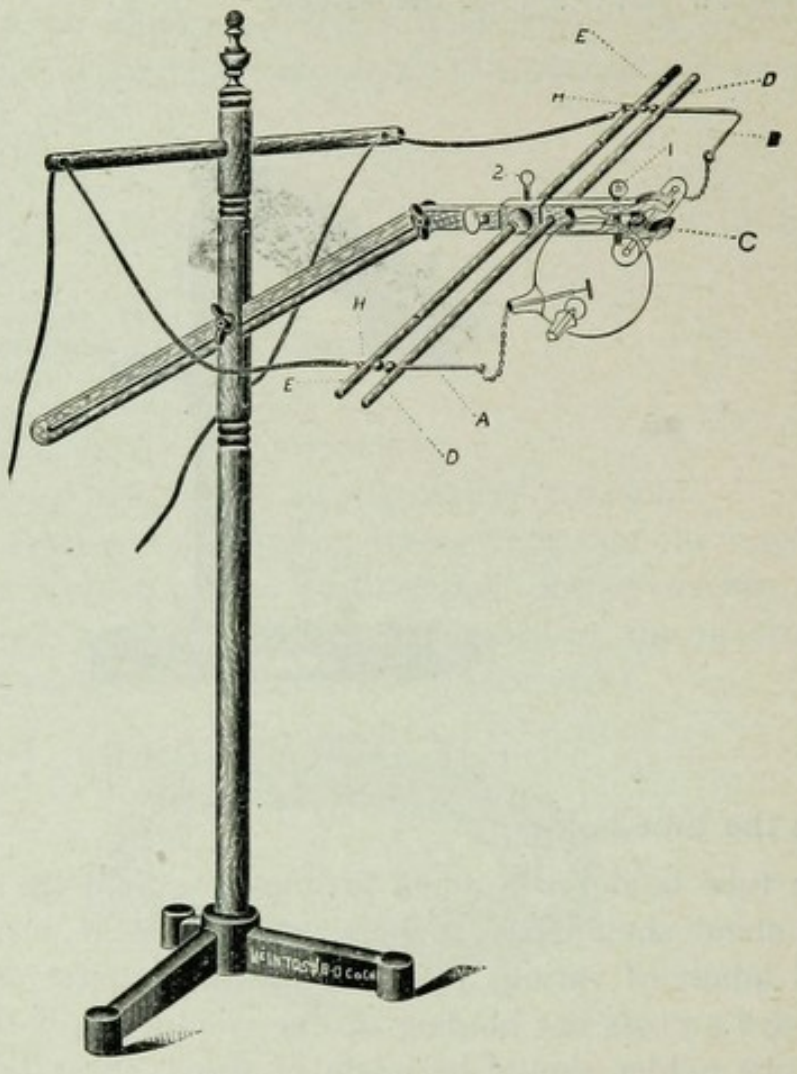
A tube holder should be made of wood, so as to be as nearly a non-conductor as possible. The accompanying cuts show a small tube holder for use on a table, and a large tube holder which stands on the floor.

COMBINED TUBE HOLDER, SPREADER AND POLE-CHANGER

This shows a combination of a tube holder with a pole-changer, that is convenient, and strong, and handsome. It is simple and efficient, and will be appreciated by all who work with the X-ray to any extent, especially those who use the static machine for generating their rays, as the pole-changer device comes in handy when the polarity changes, as it frequently does in some types of machines. By means of this holder the position of the tube may be reversed, very quickly without changing the tube connections.

It also has in the circuit a spark gap on each side which increases the effect.

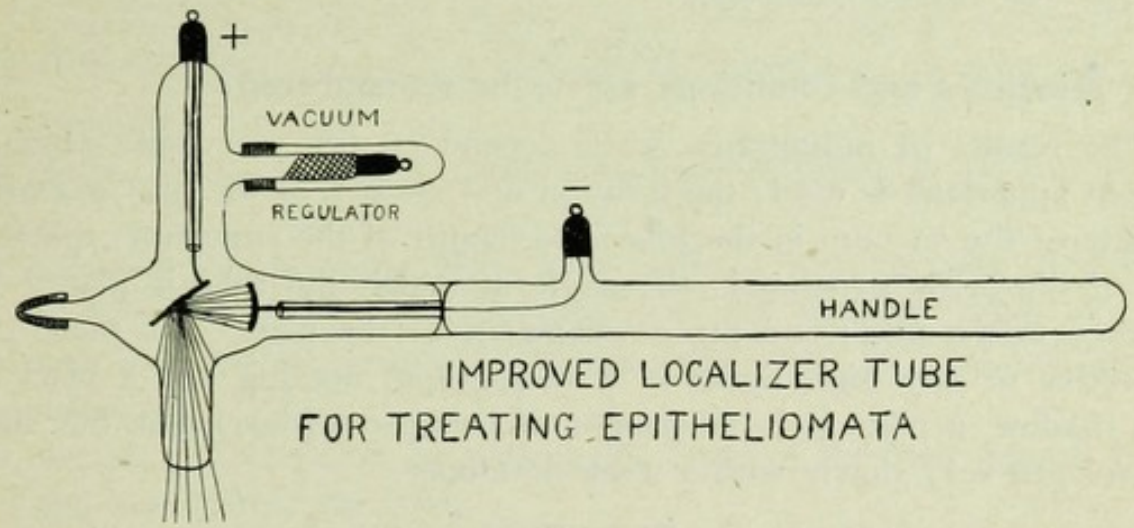
The device is made of wood, is strong and light, and is universally adjustable so as to be used in any desired position.



HOW TO LOCALIZE THE X-RAY

In treating small growths, especially when near sensitive organs, like the eye, it is necessary to localize the area of exposure in some way. This may be done by covering the tube with some opaque material like the tube shield, shown elsewhere, but which is more often used as a protection to the operator. This tube shield has various size openings in it. Another method of localizing is to use a metal shield placed between the patient and the tube as illustrated in another place by the Allen shield. Another way is to cut small holes in pieces of lead or tin foil, lead glass, celluloid, aluminum or leather, with the hole just the size of the growth to be treated. Another and the best way for such condition as epithelioma is to use a localizer tube, like the one shown on page 293.

This improved localizer tube is a modification of the tube invented by Besser of Gehlburg, Germany. Improvement consists in the very small size of the hammer end of the tube, which in this instance is just the size of a silver dime. This part which allows the rays to pass through is made of quartz glass. All the rest of the tube being made of lead glass, which is opaque to the ray. This tube is to be used with a static machine and is a low vacuum, and therefore little penetration and is safer than a high



IMPROVED LOCALIZER TUBE
FOR TREATING EPITHELIOMATA

vacuum tube. The hammer end of the tube is pressed down firmly on the growth and exposures of from five minutes to an hour may be made with safety. The average duration of treatment however is from fifteen to twenty minutes daily, or every other day, according to the nature of the case. I have never observed any bad effects produced by this tube by prolonged exposures, and usually the results are beneficial, prompt and permanent. The handle is long enough to keep the hand of the operator beyond sparking distance from the negative terminal, which is less likely to spark than is the positive.

The vacuum is easily regulated and lowered simply by removing the glass cap from the chemical regulator, disconnecting the negative cord and attaching it to the regulator for a few seconds, then replace as before. This tube is light, small, strong, long-lived, easily handled, and low priced.

RADIOGRAPHY

What are the requirements for X-radiography?

The requirements to successful X-radiography are a good source of energy, which must be constant; a good tube, which may not be either costly or complicated; a sensitive plate protected from the light; a knowl-

edge of the anatomy of the parts to be radiographed, so as to avoid distortion of the shadow; a knowledge of the physics and technique of the operation; and sameone who can develop the plate after it is exposed.

There are many useful accessories which may be used by the X-ray operator, all tending more or less to make the work easier, safer and better, but these things may be added as they are needed from time to time, or omitted entirely. Good work may be done with very little apparatus, but facilities contribute to success.

What principles and conditions are to be remembered?

The results of radiograpic work depend on the care with which the different apparatus is used; the location and density of the part examined; the state of the vacuum in the tube; the length of the exposure; the steadiness of the mode generated; the angle at which the tube is placed with reference to the part; and the development of the plate. As there is no perspective or any high lights in a radiograph, nothing but a black and white shadow, a plate is in no danger of being over developed, but should be developed very slowly with a weak developer.

What are the facts about radiography?

The shadowed picture on a photographic plate excels in detail and accuracy the shadow cast upon the fluoroscopic screen. Successful radiography requires a good exciting apparatus, good tubes, a thorough knowledge of both, and skill in the management of the photographic plate. Unless one has some knowledge of photography, he had better let the photographer develop his negative and finish his prints.

For radiographs of the head, hips and abdomen the coil is preferable. For all other parts of the body a static machine may be used. The patient should be stripped of clothing about the part to be examined to avoid confusion from shadows of buttons, pins, etc. Splints, iodoform, and plaster of Paris dressing should also be removed, though the bony shadows will show through them. The recumbent position is best in most examinations, because there is less liability of movement during the exposure. Common sense and a knowledge of anatomy will direct the operator in posing his patient, always remembering that the nearer the part to be radiographed is to the film side of the negative the sharper will be the shadow.

The higher the vacuum of the tube the more penetrating will be the rays produced. The degree of penetration will be determined largely by the thickness of the part to be radiographed. The bones of the extremities yield the brightest shadows to a tube of comparatively low vacuum; a

harder tube will show less contract between bones and soft structures. The chest requires a medium tube, and the head and pelvis a high one.

For the purpose of comparison, it is wise to radiograph both extremities where only one is abnormal. This plan is imperative where pictures are to be introduced as evidence in a court.

Malignant growths of the bones, also tuberculous bone, show more transparent than the surrounding bony tissue. Malignant growths of the soft parts cannot be positively diagnosed by the ray.

The wrist and hand are the easiest parts of the body to radiograph. Exposing from back to front will show most lesions, but a side view can be taken if necessary.

The elbow should be radiographed through the plane of the condyles if possible.

The shoulder may be taken from front to back, or from back to front. Usually the tube should be placed directly over the glenoid cavity, but if it is desirable to show the acromion, the tube had better be over the point of the shoulder.

The clavicle is best shown by placing the front of the body against the plate and the tube behind the back.

In the foot the metatarsals and phalanges show best in an antero-posterior view.

Injuries of the ankle usually require both the antero-posterior and a lateral view. Potts fracture is readily diagnosed by a front view.

The lateral view of the knee joint is most useful, and unless there are contra-indications it should be taken in a semi-flexed position.

The hip-joint is the most difficult subject of all, except in children. Best have the patient lie upon the back with thighs adducted.

The skull, face and neck show most abnormalities by a lateral view.

The chest shows best if the exposure does not have to last longer than the patient is able to hold his breath. The respiratory movements cause some blurring.

Stones in the kidneys, ureters and gall-bladder can seldom be located by a static machine. Use a moderately low tube with a long exposure, and if unsuccessful the first time, try again.

The distance of the tube from the plate differs in various parts of the body.

Every operator must learn from experience the time necessary for good results with his particular equipment. With a static machine of 12 revolving plates, 30 inches in diameter, and running at not less than 400 revolutions per minute, the following table may prove helpful to the beginner:

A 24 plate static machine requires about as follows:

Part	Distance	Time
Hand	12 inches	4 minutes
Foot	12 inches	4 minutes
Shoulder	15 inches	10 to 14 minutes
Chest	20 inches	15 to 30 minutes
Hip	25 inches	20 to 35 minutes

A 16-inch coil with mercury interrupter requires about as follows:

Hand	12 inches	5 to 10 seconds
Foot	12 inches	10 to 15 seconds
Shoulder	15 inches	45 to 60 seconds
Chest	18 inches	45 to 60 seconds
Hip	20 inches	4 to 7 minutes

The same coil working on an electrolytic interrupter will do this work in about one-fourth the time above specified.

Of what value are intensifiers?

Intensifying screens are for the purpose of lessening the time of exposure. They consist of sheets of celluloid coated with some fluorescing substance, usually barium platino-cyanide, or calcium tungstate. One of these placed in contact with the film side of the negative to be exposed reduces the time of exposure to about one-fourth that ordinarily required.

X-RAY PLATES

What X-ray plates are best?

Any rapid photographic plate will answer. Some manufacturers make a special double emulsion coating for this purpose. They come packed six in a box, and accompanying them are envelopes for each negative. The plates should be kept in a dry, dark room, and unless solid or plastered walls intervene between the machine and the dark room, they should be kept in a box lined throughout with lead. When ready to make radiograph close dark room, take plate from the box and place, film side up, in the black envelope and this in turn in the pink envelope. The film side of the negative should always be in contact with the smooth side of the envelope. Place the negative on the table, film side up. If the table is padded, a board must be placed under the plate to prevent breakage. If the weather is hot and patient is sweaty, lay a piece of blotting paper over the outer envelope. See that your apparatus is in perfect order. Place your patient in the best possible position to bring out the abnormality looked for.

For the development of plates, see the literature accompanying same.

There is much to be learned which cannot be taught, but which will come to you as you go along, as the result of your own observations and experiments.

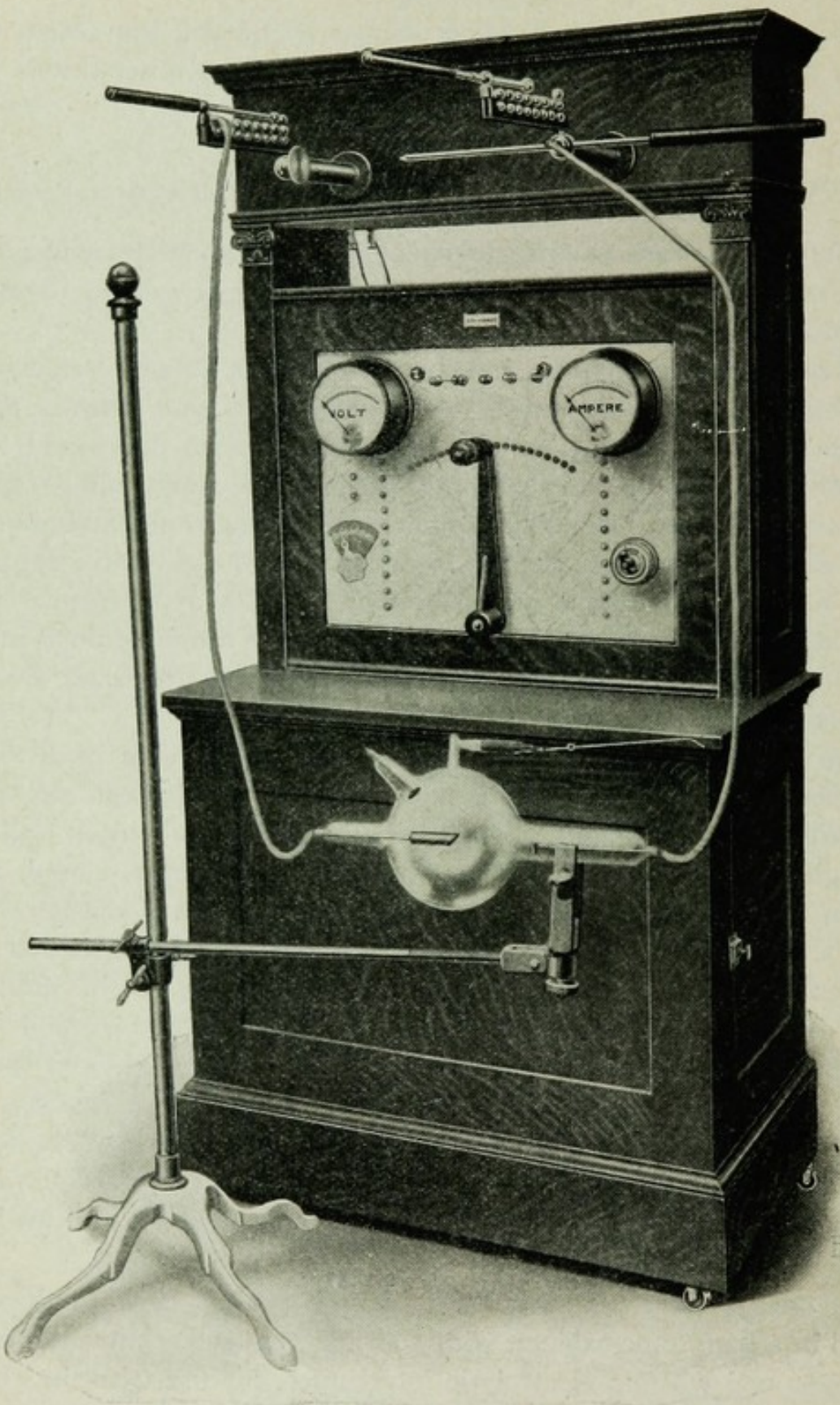
THE PROPER APPARATUS FOR PRACTICAL RADIOGRAPHY

The volume mode is limited to the total area of inductive surface and therefore a static machine with 24 plates delivers a larger volume of mode than one with, say 4 plates.

Insufficiency of mode volume, is what causes weak definition and poor contrast to show in an X-ray tube. Dr. Rollins of Boston built a large static machine with 16 plates, 6 feet in diameter, and with this monster he got splendid results in fluoroscopy but little is said about radiography. The static machine being insufficient, we have to turn our attention to other more efficient apparatus, capable of supplying the needed energy to light up an X-ray tube with the proper volume of mode at the proper tension. This apparatus must be capable of furnishing a uni-directional mode of from 1 to 30 milliamperes at a voltage of from 60 thousand to 500 thousand volts.

We turn at once to a so-called static transformer with open core, called induction coil. By sending a momentary mode through the coil, which we will call the primary, a meter in the secondary circuit will be deflected slightly in one direction when the primary circuit is closed, and vigorously in the other direction when the primary circuit is opened. By introducing a soft iron core within the primary winding, the deflection becomes much more marked during the closing and opening of the primary circuit. By increasing the secondary turns over the primary, we find that the tension or electro-motive force called the E. M. F., increases in direct ratio as the number of turns increases in the secondary. For instance, if there are ten turns in the primary and 100 turns in the secondary, the ratio will be 1 to 10. If an interrupted or alternating mode of 10 volts pressure is sent through the primary, a pressure of 100 volts will be indicated at the terminals of the secondary.

The cut on page 298 shows a form of high tension X-ray induction coil mounted in a handsome cabinet, with volt and ammeter, controller, multiple spark gaps and with an electrolytic interrupter, for use with the alternated street mode. This is one of the best coils for this purpose, and will do almost instantaneous radiographic work.

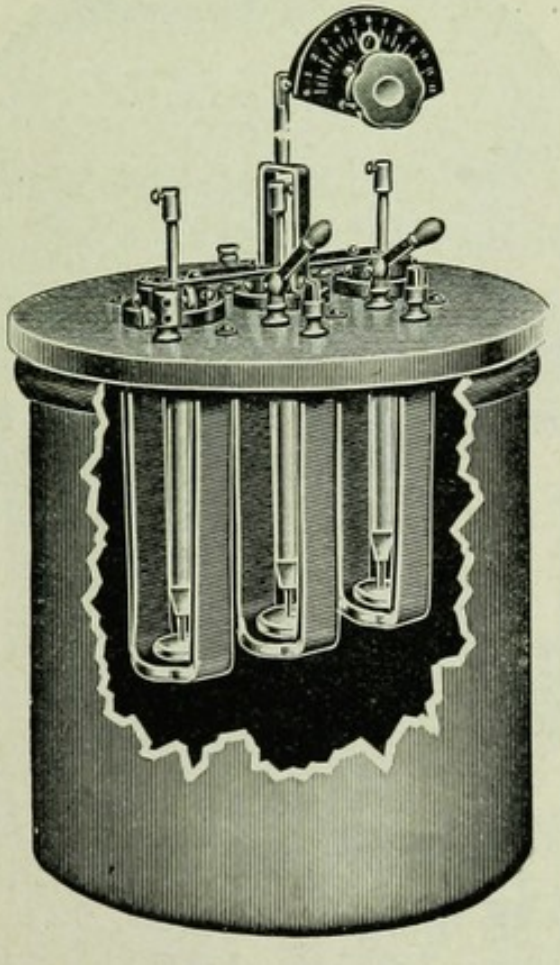


X-ray Induction Coil, with electrolytic interrupter.

INTERRUPTERS

What are the three kinds of interrupters?

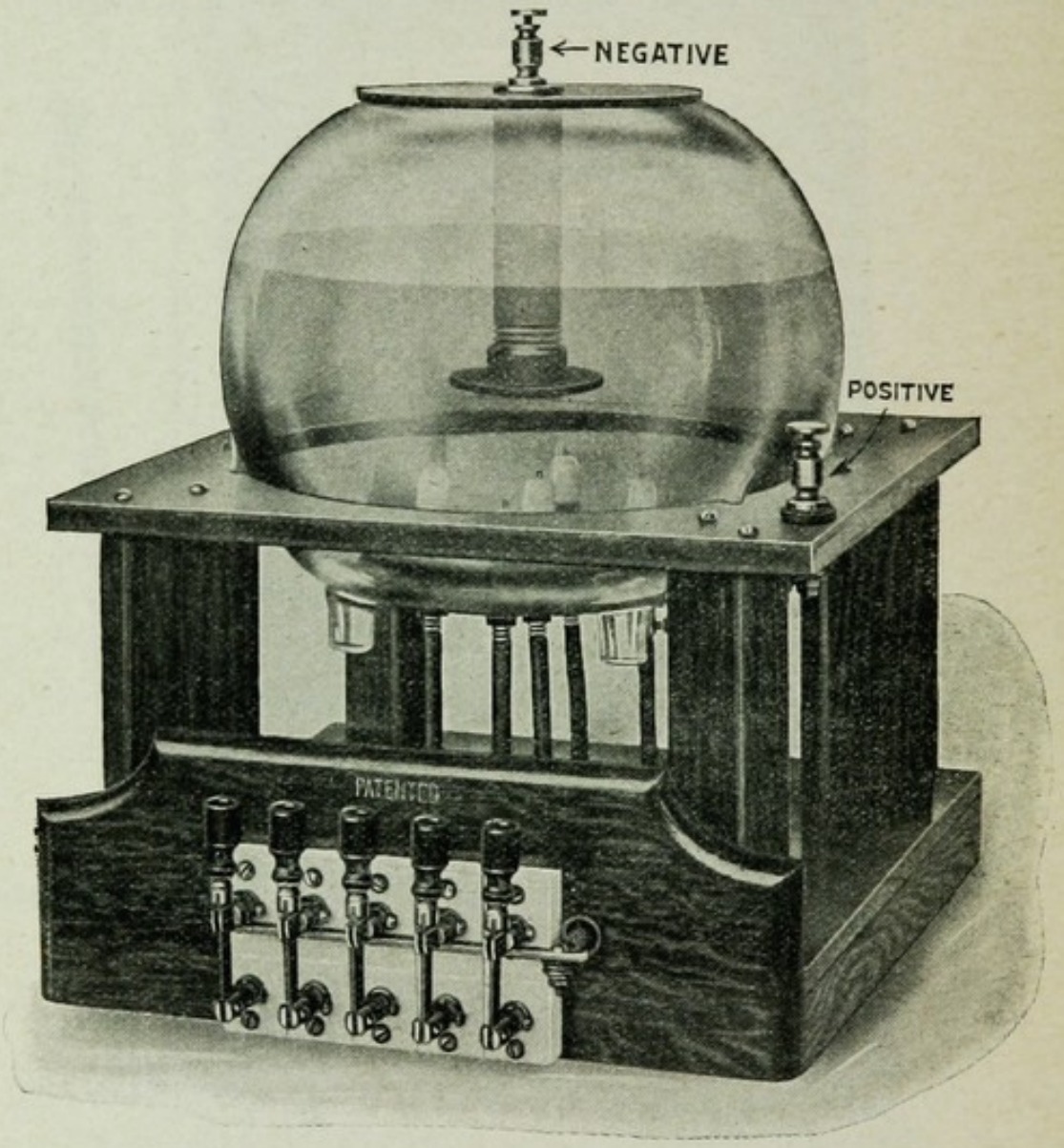
There are three kinds of interrupters used in connection with coils for the generation of modes for energizing X-ray tubes, viz: Mercury jet turbine, rotary break, and the electrolytic. Of these the last named is the more preferable, as being most noiseless, economical and convenient.



ONE TO FIVE POINT ELECTROLYTIC INTERRUPTER

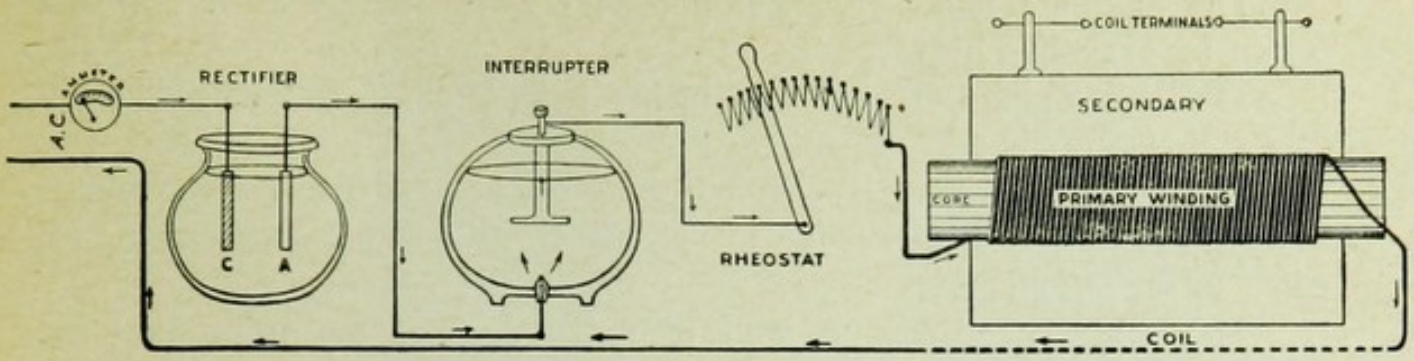
The electrolytic type of interrupter was the first to be used and while much time, labor and expense have been expended in devising other forms of interrupters, still the original is the favorite, because it is the simplest and easiest and cheapest to operate. A single point interrupter will do for ordinary work, but by exposing two or more points, the interruptions will be faster, and the bubbles of gas will form and explode at shorter intervals, and the resulting service more even and efficient. This one is practically three times the size of others, although it occupies no more space than the single cell, and it will not heat when in operation. The dial shown

in the cut is the same one shown on the marble plate of the complete X-ray apparatus shown on page 298, and is used to lower or raise the platinum contact rods in the electrolyte solution, either together or separately as desired by the operator.



K-K Inverted Interrupter.

The inverted interrupter shown here, is a new departure from the old plan, in that it is the old style Wehnelt interrupter turned upside down, so as to get more even interruptions, as the bubbles rise through the liquid. Actual test by a number of operators has proven the usefulness of the improvement.

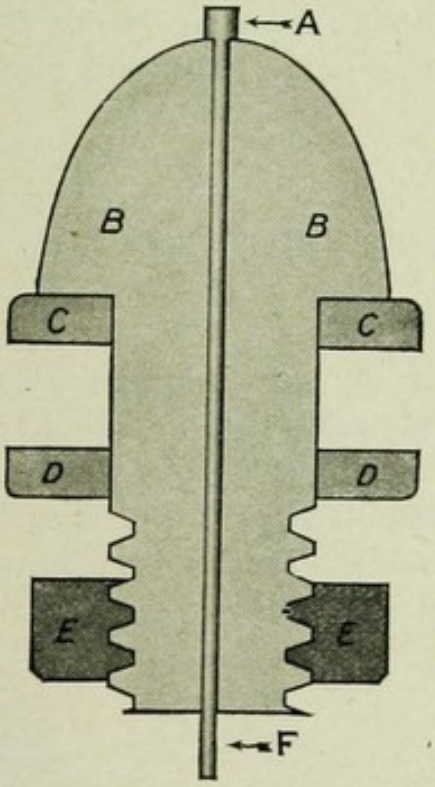


This diagram shows how the apparatus is connected in series, and the simplicity of the arrangement of the various parts.

The following points of merit will appeal to all:

The inverted type gives a uniform flow because the hydrogen bubbles pass naturally upward from the point "A."

It does not stick or intermit, as the platinum stem "F" is smaller than its exposed tip "A" and cannot pass enough amperage to overheat it.



The interuptions are sharp and complete as the platinum rod "F" is burnt into the porcelain plug "B," so that the tip "A" only is exposed to the fluid.

The porcelain "BB" cannot burrow funnel shape as the platinum shoulder protects its thin edge at "A."

The platinum point "A" will not wear away rapidly as it does not soften by excessive heat.

The spark plugs are but two inches long and are as easily changed as a gas engine plug.

The cut glass globe is one half inch thick, very transparent and is most interesting and instructive to see the electro-chemic action going on when in operation.

The negative element is well insulated so that the juice does not flow on the fluid surface.

The poles are wide apart, thus preventing leakage and short circuiting.

The container is safe from breakage, as the soft rubber washers "CC" and "DD", press firmly against the sides of the glass and are locked in that position by the threaded hard rubber nut "EE."

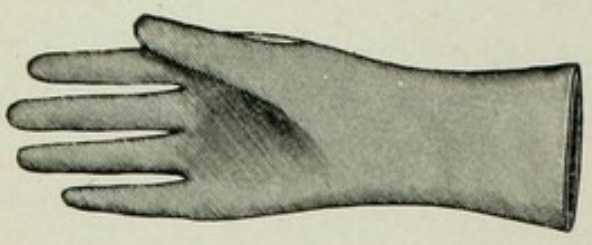
It requires no cover, water jacket or cooling device, cleaning or other attention, and is ornamental as well as useful.

It may be placed in any coil stand or cabinet, or hidden away in any closet, loft garage or out of the way place, as desired, each electrode being connected by the five switches in your X-ray room by means of copper wires. It is made with five points only and measures 12 x 12 x 14 inches high.

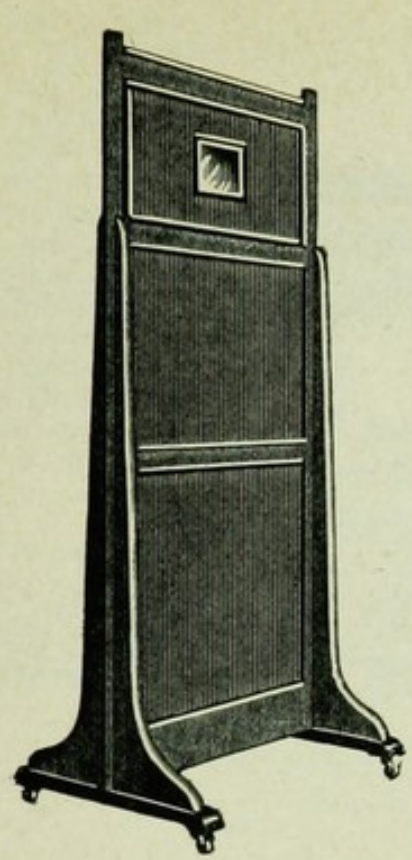
OPAQUE X-RAY PROOF GLOVES AND GOWN

What protection is advisable?

For the protection of the operator against the cumulative action of the X-rays, it is always advisable that he should wear the flexible opaque, X-ray proof gloves and gown or apron shown here. These precautions will prevent dangerous complications, that may be accidental, but nevertheless distressing if not fatal. They will lessen or prevent the dermatitis, depilation or sterility, that may follow repeated exposures to the action of the X-ray.



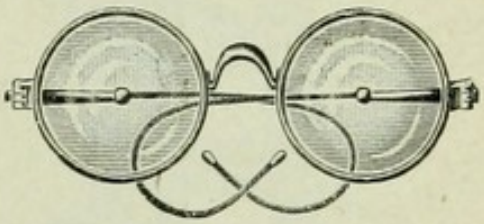
X-RAY GLOVES AND APRONS
X-ray gloves, for preventing burns. Always order size larger than worn.

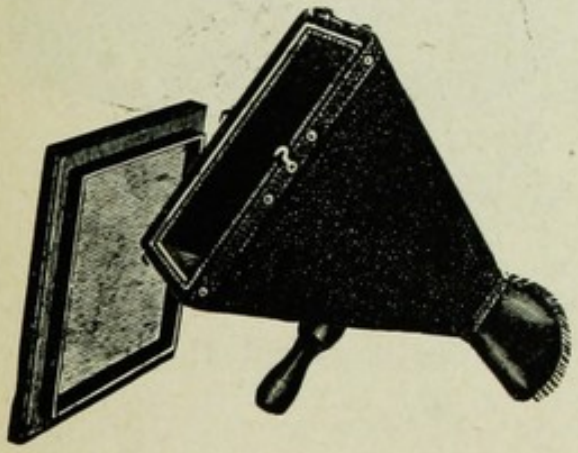




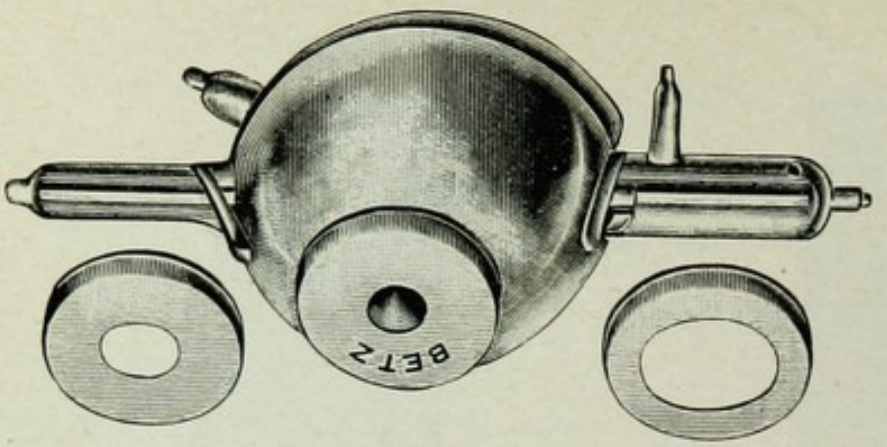
These show a movable shield or screen made of sheet lead with a lead glass observation window, behind and through which the operator may stand, and observe the working of the tube, and if he must approach the tube when in use he may be protected by the gown and gloves.

X-ray Spectacles. For protecting the eyes.

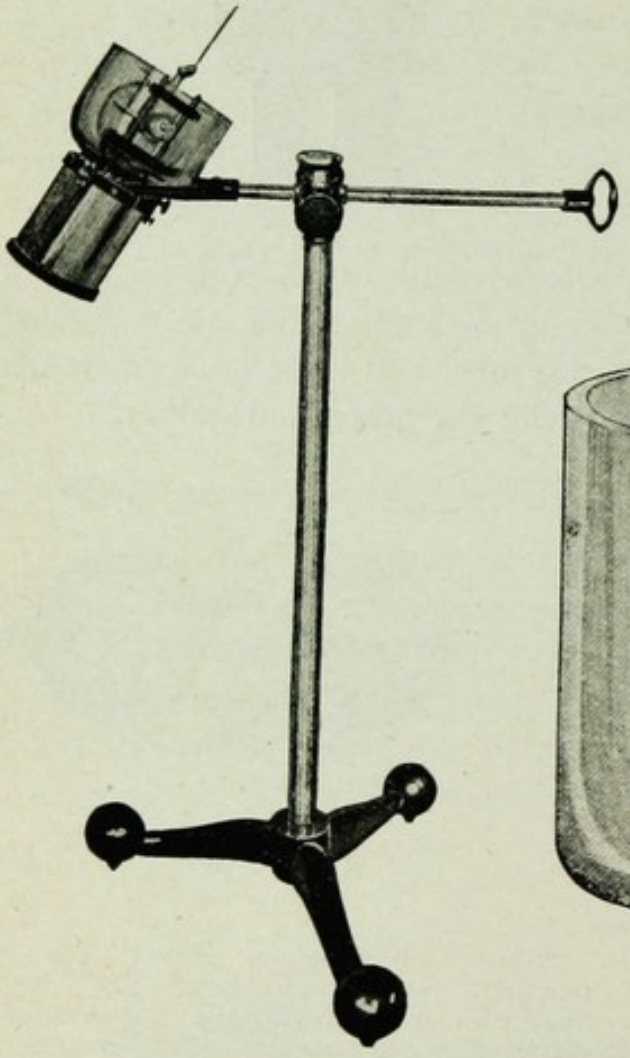


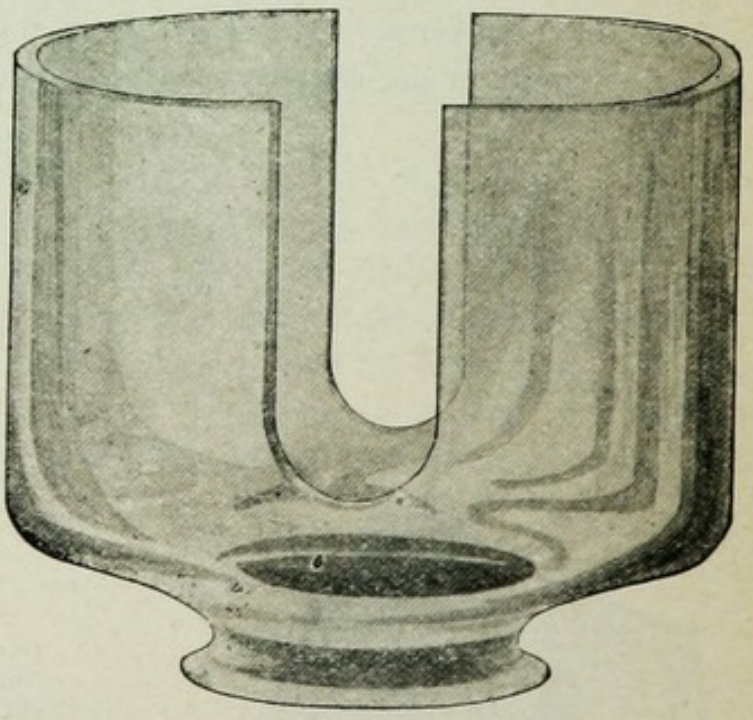


Safety Fluoroscope. Never use a wooden fluoroscope box. The best operators in this country use a steel safety fluoroscope trimmed with enameled leather and fur. Has safety shutter for protecting the eyes, beard, etc.

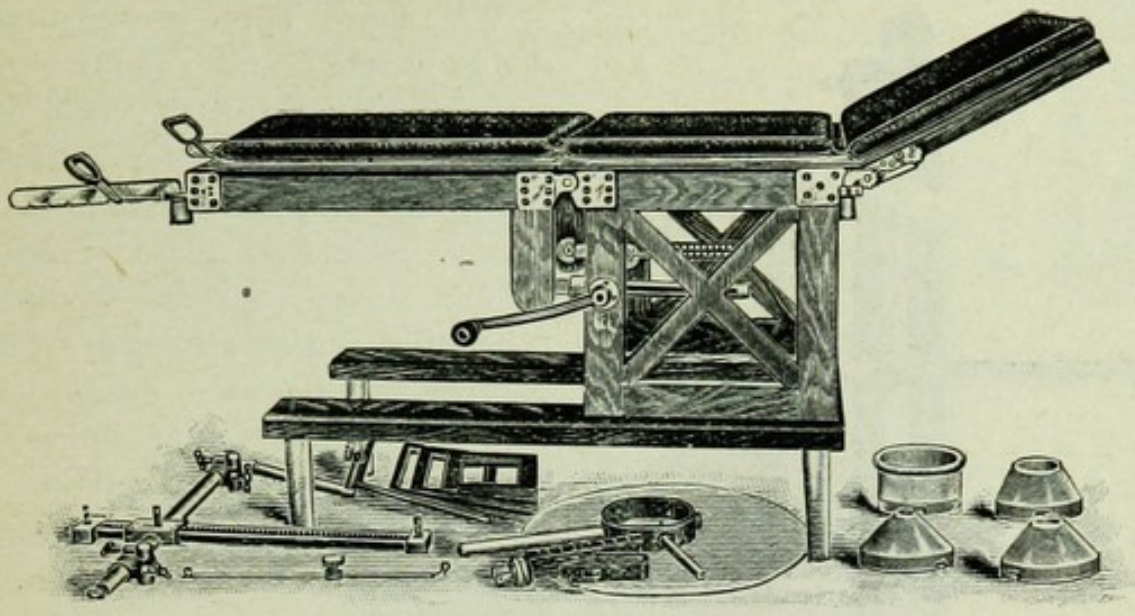


X-ray Shield. For protecting the operator and patient. Made of a composition that is impervious to the rays, also a non-conductor so there is no danger of a spark or puncture. 3 caps from 1 to 3 inches sent with each shield, making 4 different size openings, also good for making pictures as they cut off all secondary rays, thus improving the definition.

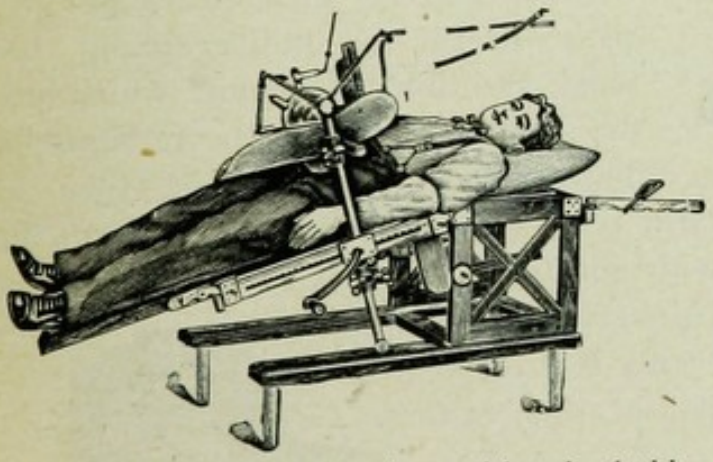




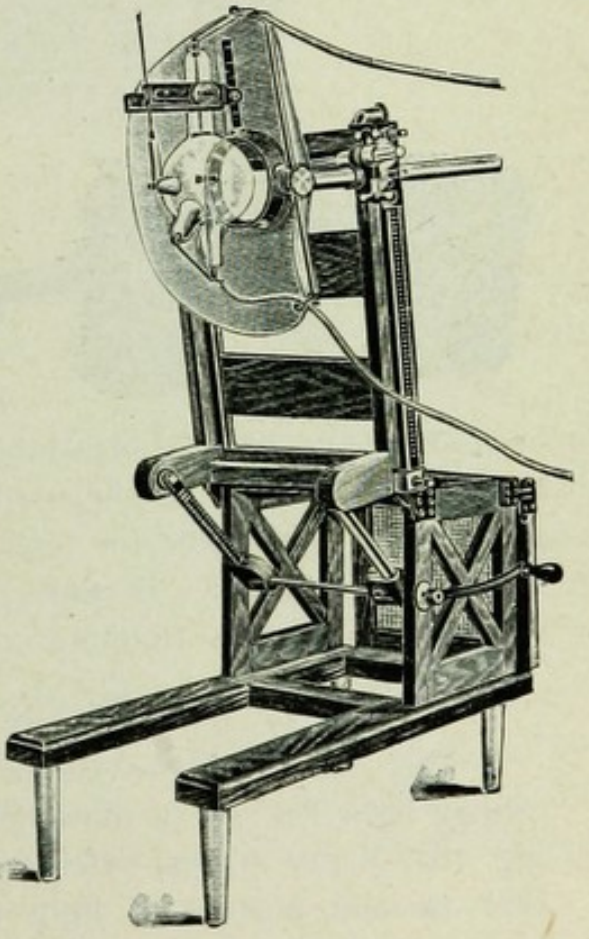
The tube may be surrounded by a lead glass shield as shown here, which effectually stops the ray from any direction except through the window at the bottom.



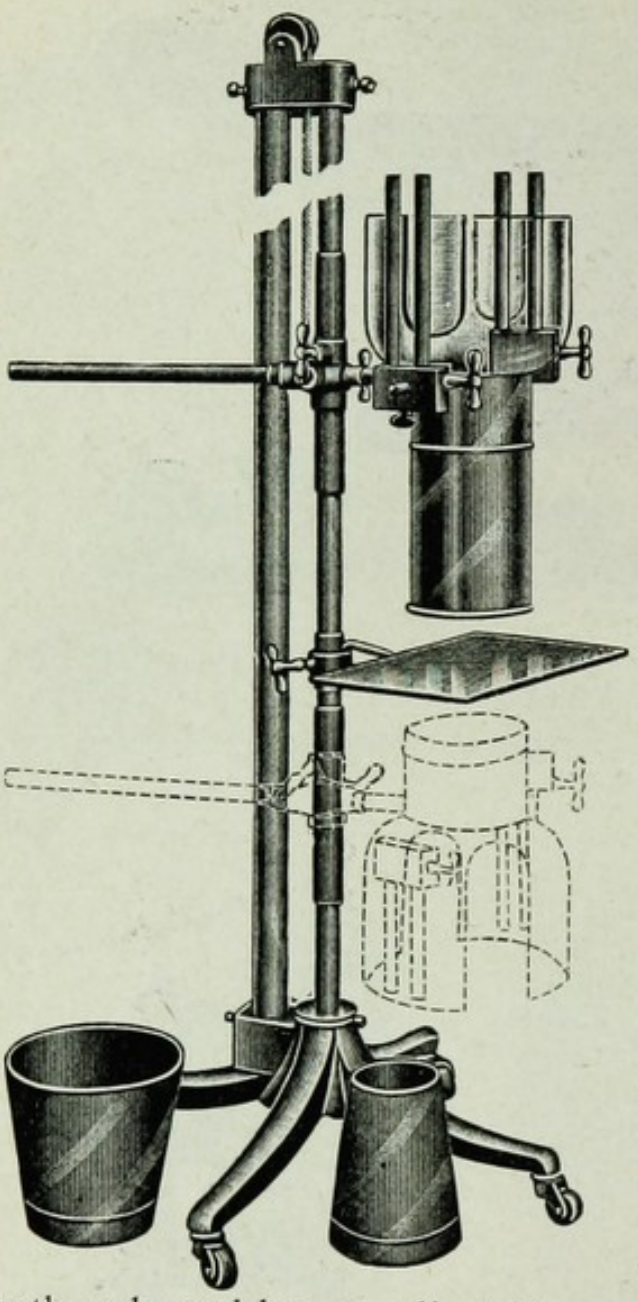
CEDERGREN X-RAY TREATMENT, OPERATING AND AUTO-CONDENSATION TABLE



A perfect combination, with tube holder, screen, compression diaphragms of various sizes, X-ray tube may be placed above, below, in front or behind or on either side of patient, with stirrups, sliding slat and reed bed. Gives absolutely every position or angle. Either end can be raised or lowered. Mounted on 10 inch glass legs.



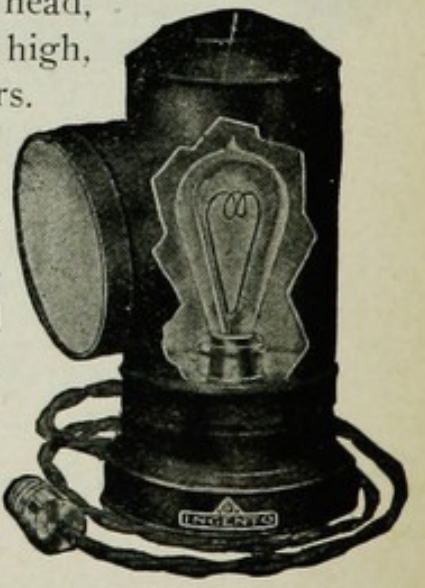
SELF-BALANCING COMPRESSION DIAPHRAGM



We show here a self-balancing X-ray camera and compression diaphragm. It limits the field of exposure and is useful for localizing in X-ray work. The active tube is inclosed in a lead glass screen with various size opaque compression tubes that can be attached. This apparatus can be used in any desired position with the tube either above or below the object to be radiographed, and is so evenly balanced as to be easily lowered or raised and may be locked in any position.

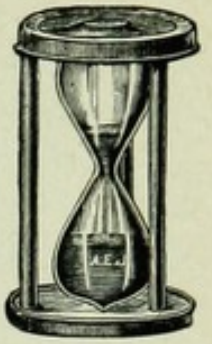
This device cuts off all of the tangential rays which have a tendency to blur the image, and also fixes the object so that it will not move, and, by compression, it will lessen the distance between the tube and the plate, which is important when radiographing thick parts. It also produces a partial anæmia, which makes the shadow clearer. This device is especially useful in radiographing for renal and biliary calculi, which are the hardest things to radiograph. This device supports the tube at both ends, and has an adjustable arm reaching over thirty inches from the standard, so that it can be used with any table. It also has an adjustable table for resting the arm, foot or head, as shown in the cut. It stands seventy-two inches high, weight 160 pounds, mounted on ball-bearing casters.

HANDY RUBY OR ORANGE LIGHT

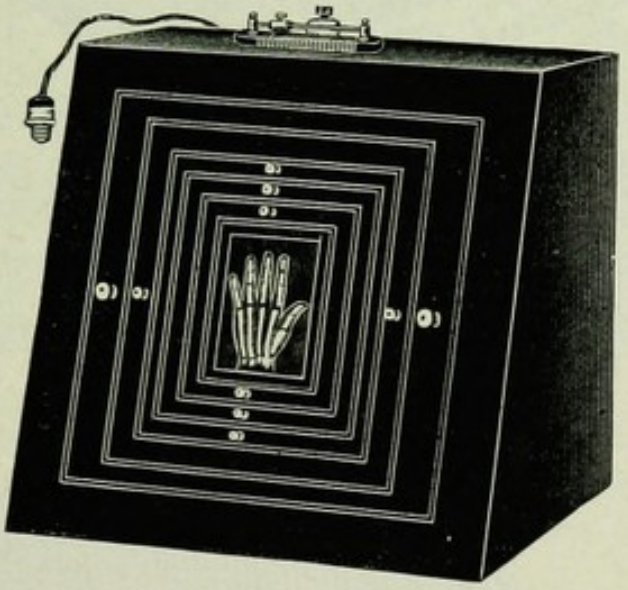


This shows a convenient portable ruby or orange light for use in the dark room for developing the X-ray plates safely. It is so arranged that various degrees of light may be used or it may be quickly turned off entirely. It is simply attached to any lamp socket.

SAND GLASS TIMER



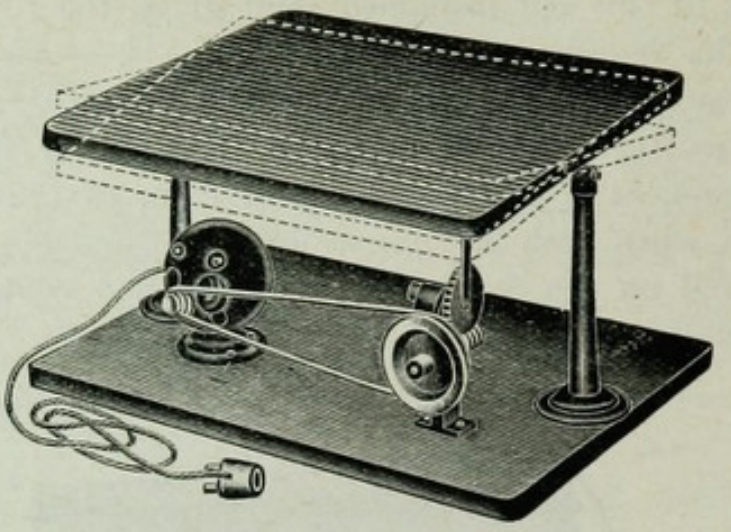
By means of this old fashioned sand glass, the time of exposure or the length of treatments may be accurately measured, or the time of development of plates gauged, without referring to the watch or clock. It is specially useful in the dark room, as it may be placed in front of the ruby lamp, and seen when both hands may be soiled and busy, or it may be placed on the X-ray coil, and watched while the exposure is being made.



Diagnostic Box. For the correct interpretation and diagnosis of radiograph, especially where organs are involved which do not offer much contrast.

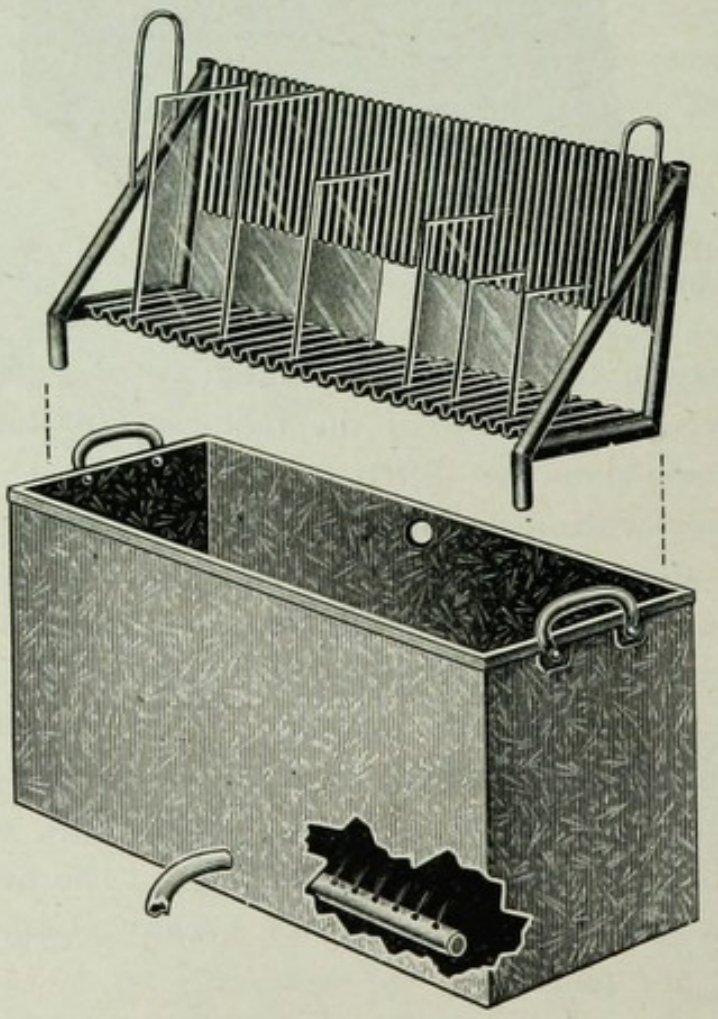
This diagnostic box or negative examiner is admirably adapted for the close study of the details of the radiographic plates. Various sized sash will accommodate the different sizes of plates. It is to be used in a dark room with a bright light behind the negative. Thus only the shadow is shown, sharply in silhouette, by the light projected from a dead white background to a ground glass field behind the radiographic plate. This gives a sharp contrast, and protects the sensitive film from the radiated heat, in a long examination. It takes in all plates, from 5 x 7 to 14 x 17, either perpendicularly or horizontally. Some plates have to be shown to the patient or his friends, or in court, and this is a most excellent way to show them to best advantage. The details of a plate are often lost when printed and mounted on a card. Complete with rheostat controller, cord and plug.

X-RAY PLATE TITUBATOR



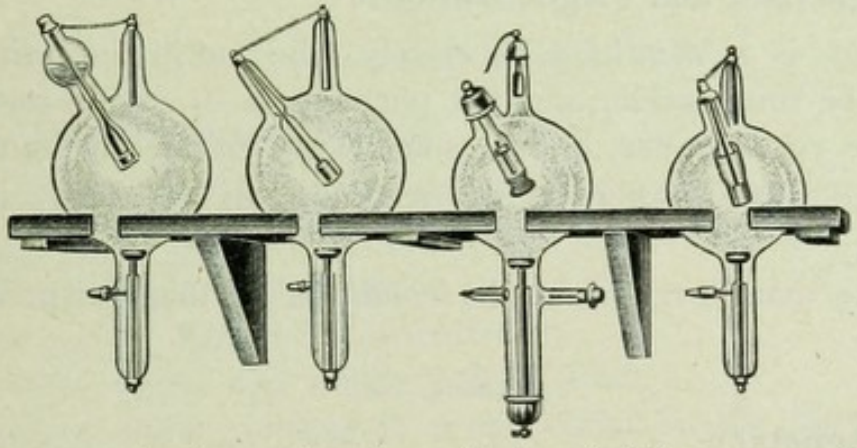
This shows a simple device by which the X-ray plates while in the process of slow development after exposure, may be slowly rocked, by means of a small electric motor attached, thus saving the time of the operator, and insuring the even development of the plate.

X-RAY PLATE FIXING BATH AND DRYING RACK



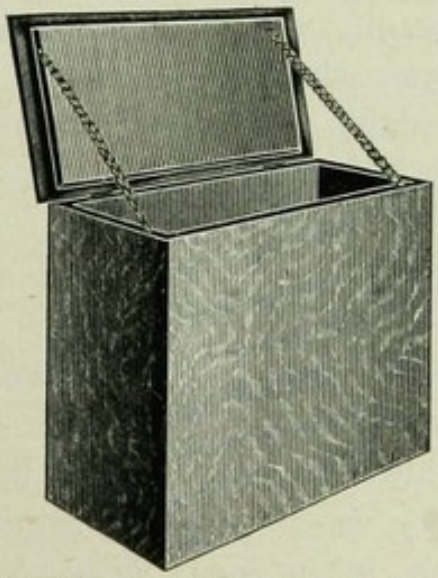
This shows a new form of fixing and washing bath, as well as a drying rack. After the plates are developed they may be placed in this rack and bath for fixing, or it may be used as a washer. The plates are held vertically, and the water plays gently on them from below, thus preventing the deposition of chemicals, specks, spots, and keeps them from peeling, or wrinkling. After they are thoroughly washed, the holding rack is simply lifted from the tray and the plates may be dried without handling, thus insuring the films from damage from handling, as they need not be touched.

TUBE HOLDER RACK



This shows a simple and safe rack for holding a number of tubes. It is screwed to the wall or in the wall case, and keeps the tubes from knocking together, and from accident, and they are always within easy and quick reach when needed.

X-RAY PLATE BOX



X-ray plates should be kept in light and X-ray proof containers, and this shows a box lined with sheet lead, which insures the plates from being fogged, by the accidental exposure to stray light or rays.

MAGNETIZATION

What is magnetism and magnetization?

Magnetism is a *condition* so closely allied to the *condition* of electricity as to be inseparable, and the phenomena of manifestation of both *conditions* are very similar, and in some ways follow the same laws.

The force manifestation of the *condition* of electricity is known as electrification.

The force manifestation of the *condition* of magnetism is known as magnetization.

What are magnets?

There are two kinds of magnets, viz: The natural magnet, which is known as the lodestone, found free in nature, and the artificial magnets, in which the peculiar properties of magnetization are artificially induced.

Further there are two kinds of artificial magnets, viz:

Temporary magnets, which are made of soft iron, and which acquire magnetic properties very readily, and then lose them as readily as acquired, and the permanent magnets, which are made of hardened or cast steel, and which cannot be so highly magnetized as the soft iron, but which retain magnetization more or less permanently.

State the properties of magnets.

The presence or existence of the magnetic *condition* in any object is shown by the following phenomena:

1. By its power of attracting iron filings, needles, etc.
2. By its attracting or repelling other magnets.
3. By arranging itself, when freely suspended, so as to parallel the polar axis of the earth.
4. By its power to impart its own magnetic properties to iron or steel.

What is electro-magnetic induction?

We have shown the zones of influence surrounding a primary live wire, and constituting the electric field. If this wire is passed around a magnetic core the strength of the field is increased, and constitutes an electro-magnetic field.

If a copper wire is immersed in the electro-magnetic field or zone and the free ends connected to a meter, there will be registered a secondary mode strength.

This secondary mode is generated in the secondary wire or coil by electro-magnetic induction.

LAWS OF MAGNETIZATION

What are the laws of magnetization?

A unit magnetic pole is that which at a unit distance from an equal similar pole will repel it with unit force, and with this definition the laws of magnetization may be stated thus:

1. Magnetization cannot be insulated.
2. Like poles repel, and unlike poles attract.
3. Attraction and repulsion is proportional to the strength of the poles.
4. Attraction and repulsion is inversely proportional to the square of the distance between the poles.
5. The strength of the magnetic field at any point is the force with which the field would act on a positive unit magnetic pole at that point.
6. The lines of magnetic force follow the direction, at every point, of the lines corresponding to the direction of the prime magnetic potential.

The usual insulators or dielectrics, controlling electrification, have no effect upon magnetic induction, which will exert its influence right through wood, paper, glass, air, etc., just as if the generator was in actual contact, and this force acts across vacuum, water and all known substances, except across a network of iron or other magnetic material, but these are not insulators, but conductors, so that magnetization has one property which is distinctively its own, in that it cannot be insulated.

This property makes it especially valuable in therapeutics, on account of its easy application and its great power of penetration.

What is understood by stress?

When a body is immersed in a magnetic field, it is placed in a state of stress, which has a profound effect on the tissues within, and the results of

such stress are very apparent to the close student and observer of the phenomena. This stress will disturb the existing state, and the extent of the disturbance will depend on the nature and strength of the magnetic stress operating within the field, and primarily on the inducing mode.

A constant uni-directional mode will induce a strain with a fixed tension and pressure. A constant mode, but with a variable potential, will induce a strain with a pulsatory or intermittent tension. A uni-directional mode, but interrupted in character, will induce a strain of a wave-like or undulatory nature, with a consequent rise and fall of pressure. An alternated mode will induce a strain of a changeable polarity with an oscillatory tension, the frequency corresponding to the periodicity of the alternations, and the strength varying with the rate of the mode reversal.

What effect has stress on living organism?

There is necessarily a wide difference of potential between the extremes of the two polarities with each reversal, which may be likened to the distance from the top of the crest of a wave to the bottom of the next trough of the wave, and we have found that the most apparent physiological response to the magnetic stress in the living organism follows the employment of the sudden and wide difference of potential.

Variations of stress produce a liberation of corpuscular magnets from abnormal relations, and permits of a rearrangement in their normal relations, thus restoring normal conditions, and equilibrium and magneto-tonus, or health.

What is magneto-tonus?

Magneto-tonus is a state or condition of normal magnetic equilibrium, existing in a healthy body or part.

What are the physiologic effects of magnetization?

Magnetization stimulates tissue metabolism, increases oxidation, and raises temperature, the execretion of urea is assisted, elimination and assimilation are quickened. Nutrition and growth are aided. If carried to excess, over stimulation causes deleterious results, and there is loss of weight.

What is the Bennett magnetone?

The magnetone is strictly an original invention, as I never saw or heard of anything like it, and so far, no one who has seen it, has ever

seen or heard of anything like it. If there be any such it has not been published, as the writer has obtained nearly every book relating to the science of electro-therapeutics, and also many publications of an electrical nature, along physical and commercial lines without so far meeting with any suggestion leading toward the construction of such a machine or instrument.

Therefore I take a great pleasure, as well as pride, in being able to place before the medical profession at large, and the guild of electro-therapeutists in particular, something which is unique, new and original, and at the same time to be able to state with the positive assurance of experience, just what effects it will produce in certain cases.

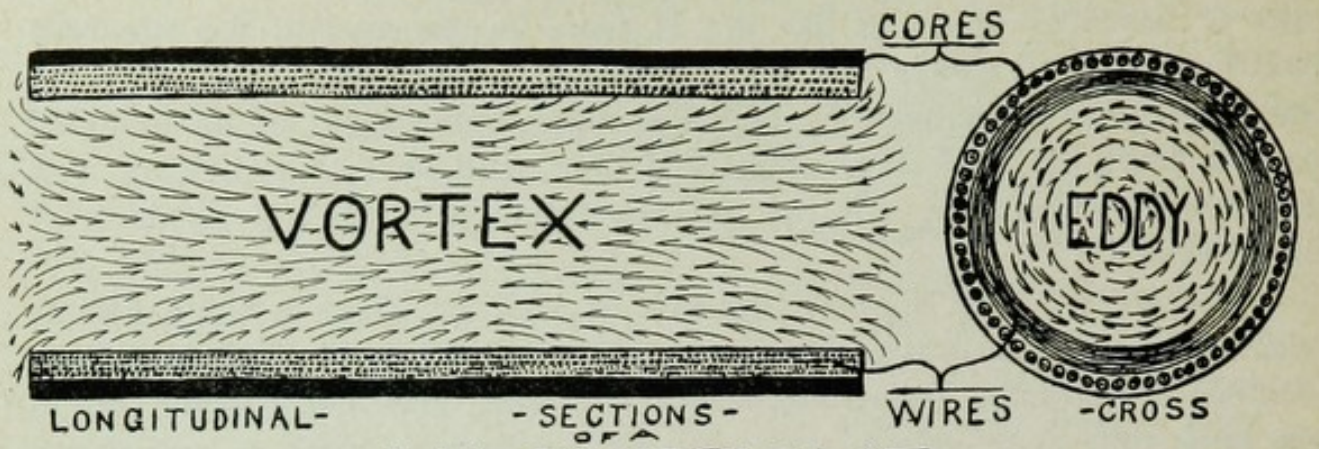
In casting about for a distinctive name for this apparatus, knowing the action of magnetization upon the organism in restoring the disturbed equilibrium to its normal magneto-tonus, and also having proved to his entire satisfaction that this invention came as near doing it as anything known could do, the inventor decided to call his apparatus a MAGNETONE, and as such it will be spoken of hereafter, to distinguish it from all other electro-magnetic appliances.

The series of experiments and failures, the discouragements, exasperations, expenses, study and labor which preceded the successful completion of the magnetones, are not of interest, except as proof of the old adage, that "There is no excellence without great labor," and to call to your minds the motto: "Per aspera ad astra."

Before going on to state the results of the therapeutic applications, I will give a brief description of the method of its gross construction, omitting only, for business reasons, the secret of the cores and method of winding, which make it distinctive, and will surely prevent successful imitation, by unscrupulous substitutors, who might offer you something "just as good." You know how it is with your prescriptions.

The magnetone consists of a great length of insulated magnet wire wound on a heavy pasteboard drum, and surrounded on the outside by a tubular battery of compound electro-magnets, the whole apparatus being saturated with an insulating material, and then tightly bound together with a layer of heavy express twine, longitudinally inside and out, and again tightly wrapped outside of all with manila postoffice twine, which wrappings are also thoroughly saturated with insulation.

The cut shows a BENNETT MAGNETONE, roughly in outline. both in longitudinal and cross section.



MAGNETONE

In the above drawing the heavy black lines on the outside in the long section at the left represents two of the compound magnetic cores.

These are also indicated in the cross section at the right by the circle of small rings outside.

In the left hand cut the several rows of dots inside the cores represent the cross sections of the different layers of magnet wire wound round inside the cores.

These are also indicated in the right hand cut by several circular lines in long section, wound inside the circle of the cores.

As stated before, if the coil is energized with an alternated dynamic mode, the magnetic field will assume the nature of a vortex. This is especially marked in the magnetone. I get the best results when using the alternated commercial lighting mode of 110 volts and 60 cycles, and the wires and cores are so evenly balanced that there is nearly complete mutual saturation, both of electrification and magnetization, so that I get the most energy from the mode with the least loss of potential, and the minimum amount of heating of the wire.

The direction of the arrows in the left hand cut indicates the vortical nature of the magnetization, from the ends inward toward the center, and this force is manifest to the extent that a heavy iron rod or gas pipe will be sucked into the magnetone from either end toward the middle. Another iron rod may be introduced, and the first one will cling to it, so that it cannot be easily shaken off, even with considerable effort. It will follow second out to the end of the tube, and will then be sucked back again into the maelstrom of magnetic induction.

In the cross section at the right, the circularly pointed arrows pointing in both directions indicate the alternating character of the parallel field of electrification surrounding the coils of wire. This partakes of the nature of an alternating eddy mode, the direction of the eddy being reversed or rotated with every alternation of the primary mode.

Thus we will at once see that when we unite these two effects, namely the eddy mode, or field of rapidly alternated electrification with the vortex mode or field of rapidly alternated magnetization, we have two forces working at right angles, and as neither can be insulated, they must penetrate and thoroughly saturate anything immersed in the field.

If there is anything at all in the theory of the corpuscular magnets in the tissues, then this shaking up will surely set them all at liberty, and allow them to resume their wonted positions, which correspond to the normal.

There is usually no sensation whatever experienced by the operator or patient when the part is immersed in the magnetone, that is, in a healthy subject, and in the diseased subject, the only feeling they appreciate is that of "the pain going away," which is the invariable result.

I tried nearly every size of wire, and many sorts of cores, among them solid and laminated, round, flat, solid sheet, and twisted cable. With some wire and cores the wire would heat and deliver no mode. With others the cores would not be saturated, and would dampen the mode. Others would choke, and some would buzz like a saw mill. Others would burn out and short circuit, but the end crowned the work.

No effect whatever, either physical or therapeutic is manifest outside the coil. It is all inside where it may be utilized.

The effects are most marked nearest to the sides.

The first magnetone was completed in April, 1902, which one was for the arm and hand. The other two, one for the leg and foot, and the one for the head and neck, were completed soon after, so that all three have been in constant and active service for a number of years, so that the tests are well proven and the results have stood the ordeal of all things, namely the crucible of time.

At first all treatments were given entirely empirically, as there was no rule to follow or formula to go by.

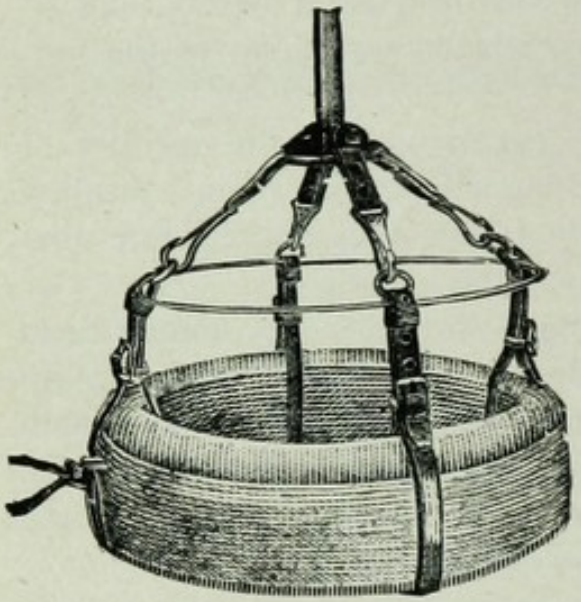
Suffice it to say that everything was fish that came to my net, and everything possible was put into one or the other of these tubes.

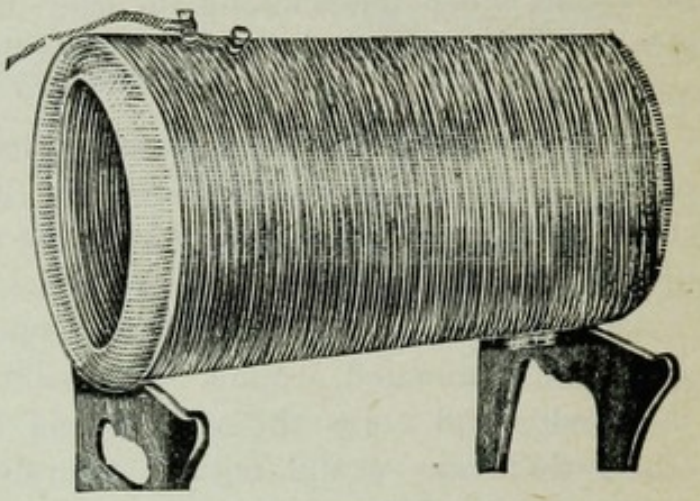
Pain is the most universally common symptom complained of, and the results in all forms of painful conditions are simply marvelous. It seems to give prompt relief in nearly every case. I have found out that certain pains are permanently relieved, constituting cures, while other pains are only temporarily benefited.

All of the indirect pains are alleviated, some quickly, some slowly, but all only more or less temporarily, some of them only while in the tube. Of course in these forms the causes operating to produce the pain were still operating, and the same cause would later produce the same effect,

so that it is folly to try to cure a pain, due to a torpid liver or an abused stomach, or a diseased uterus, or a carious tooth, till the prime cause is attended to.

But those pains which are not purely indirect, but which are due to functional derangement, are very quickly and invariably entirely cured in but a few treatments.





Without going into details of reports of cases, will say that the magnetone has for me cured the painful conditions resulting from rheumatism, articular, muscular, arthritic, gouty; neuralgia, neuritis, neurosis; old and new fractures, sprains, bruises and cuts; various head pains of doubtful origin, cerebral, anæmia and hyperæmia, insomnia and other neurasthenic symptoms; pain from eye strain, relieving intra-ocular tension; defective circulation in the extremities. In these and many other conditions it was used alone, and in many more it was used in connection with other indicated treatments.

My colleague, Professor J. M. Longcoy, has also had free access to the magnetones with instructions to apply them whenever any opportunity offered in his large practice, and he has availed himself of the permission in many instances, with uniformly favorable results, especially so in one bad case of synovitis of the knee, which got well without an operation, which had been advised, and no bad results followed. Other acute, inflammatory conditions have been allayed by the magnetones.

The cuts show the two magnetones, for the head at the left, and for the arm at the right. The one for the leg is similar to the one for the arm, but larger in diameter. Both of these are round, while the one for the head is oval, measuring about 7x9 inches inside. The head ring is

four inches wide and two inches thick, contains a quarter of a mile of wire, and one hundred and ten simple magnet cores, the whole with the hangers weighing just twenty pounds, and is to be suspended over a chair.

The magnetone for the leg is nine inches in diameter inside, an inch and a half thick, and is eighteen inches long, contains a half mile of wire, and seventy simple and compound magnet cores, and rests on a revolving piano stool.

The magnetone for the arm is six inches in diameter inside, is an inch and a half thick, and eighteen inches long, and contains a third of a mile of wire, and fifty-five compound steel magnet cores, and rests in a wooden cradle made to fit it, so as to be easily placed on a table, for convenience of application.

When this arm magnetone is energized with the 110 volt, 60 cycle mode, and a piece of common black iron gas pipe eighteen inches long is held within the tube, there is a distinct vibratory thrill felt in the hand, and there is a strong pull exerted upon the pipe, tending to suck it into the tube. If this pipe is let lie in the bottom of the tube, and large nails, keys, etc., placed in contact with the protruding end, they will be suspended and emit a loud buzzing sound, due to the fact of hysteresis going on in the pipe, for with every alternation of the mode, the pipe drops and picks up again before they get away from it, the nails or keys, at the rate of 7,200 times a minute.

If the pipe is allowed to remain for thirty seconds, it will be too hot in the middle to be held in the bare hand, and if filled with water, will raise the water to boiling point in a short time, due to the radiated heat the pipe, no doubt.

If the magnetones are used continuously for an hour, there will be a slight warmth developed, on account of the resistance of the wire to the mode in a short circuit.

My explanation of the heating of the pipe, is that the iron being elastic and soft, allows the particles of iron in it to vibrate, and knock together, and it is due to this pounding together that the heat is generated, the same as heat is generated by pounding on iron with a hammer.

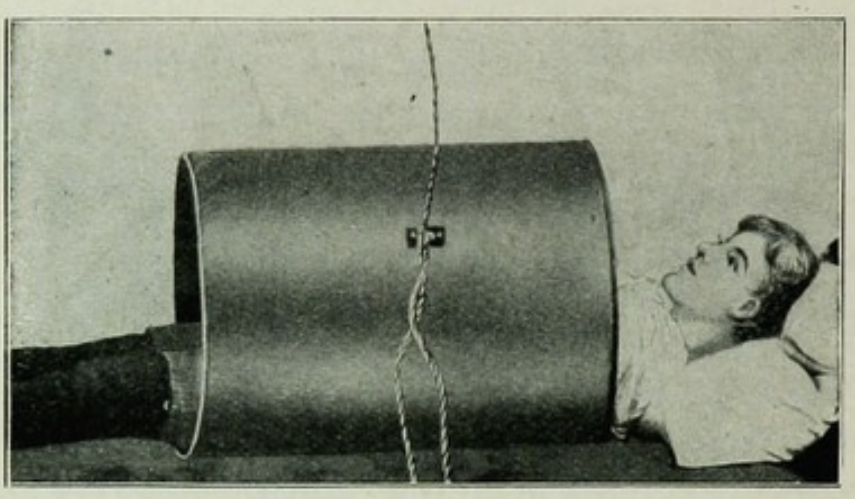
If the pipe is held in the hand while in the tube, a distinct hum is emitted from the open end of the pipe.

A steel rod held in the same way will not hum, nor will it heat as quickly, on account of the difference in elasticity, and the stronger cohesion of the steel particles.

The body magnetone is eighteen inches in diameter inside, is two inches and a half thick, and is eighteen inches long, contains a mile and

a half of wire and two hundred and ten simple and compound magnet cores, and is so arranged as to surround any part of the trunk.

The effects produced and the results obtained by the therapeutic use of these magnetones are wonderful, and if used for the symptomatic relief of pain alone, they are certainly a wonderful boon to the world. I have tried to be very explicit and full in my description of them, and the



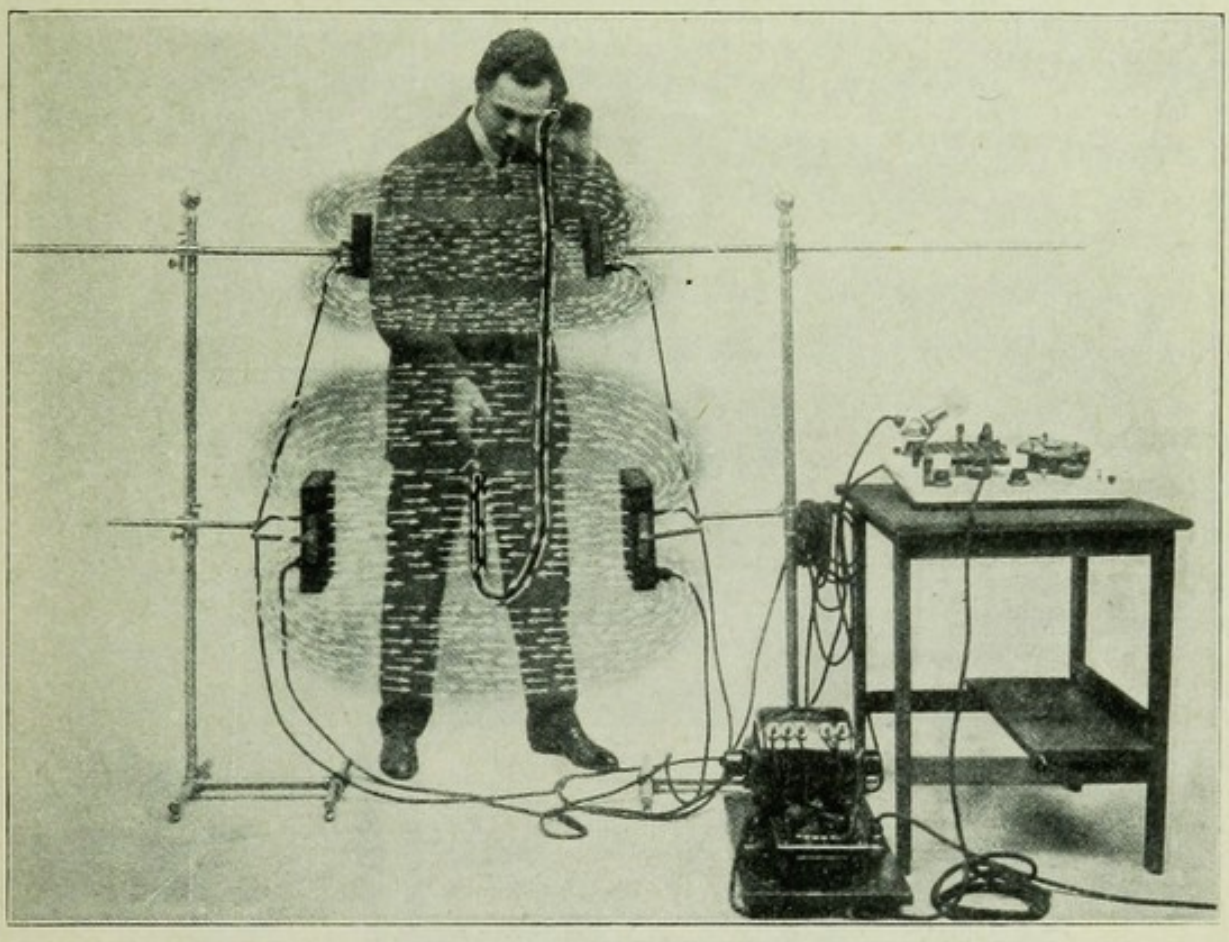
explanation of their operation, so as to answer in advance a flood of questions which are sure to follow the announcement of something new, which is good, as I and many others, personal course students, visitors, friends, patients and bores, will testify from years of observation, experiment and experience.

The exclusive right to manufacture and sell the Bennett magnetones has been reserved by the inventor, who has proven himself your friend, and he can and will make them properly, and will sell them to you cheaper than you could make them. This is his business. He will willingly give you all information concerning them, of a commercial nature. Don't try to make them yourself, for three reasons. *You don't know how. You haven't the time, and you cannot afford it.* They are hard to make and expensive when made singly, as has been found by bitter experience.

Here are a few "Don'ts:"

1. Don't try to use a cell battery mode.
2. Don't try to use a transformed direct mode.
3. Don't use them on any but the 110 volt, 60 cycle, alternated mode.
4. Don't touch the two binding posts; they are alive.
5. Don't fail to have a safety fuse block in series.
6. Don't use the common lamp snap switch. Use a knife switch.
7. Don't expect to cure everything.
8. Don't forget these seven "DON'TS."

What are the Bachelet magnetic wave generators?



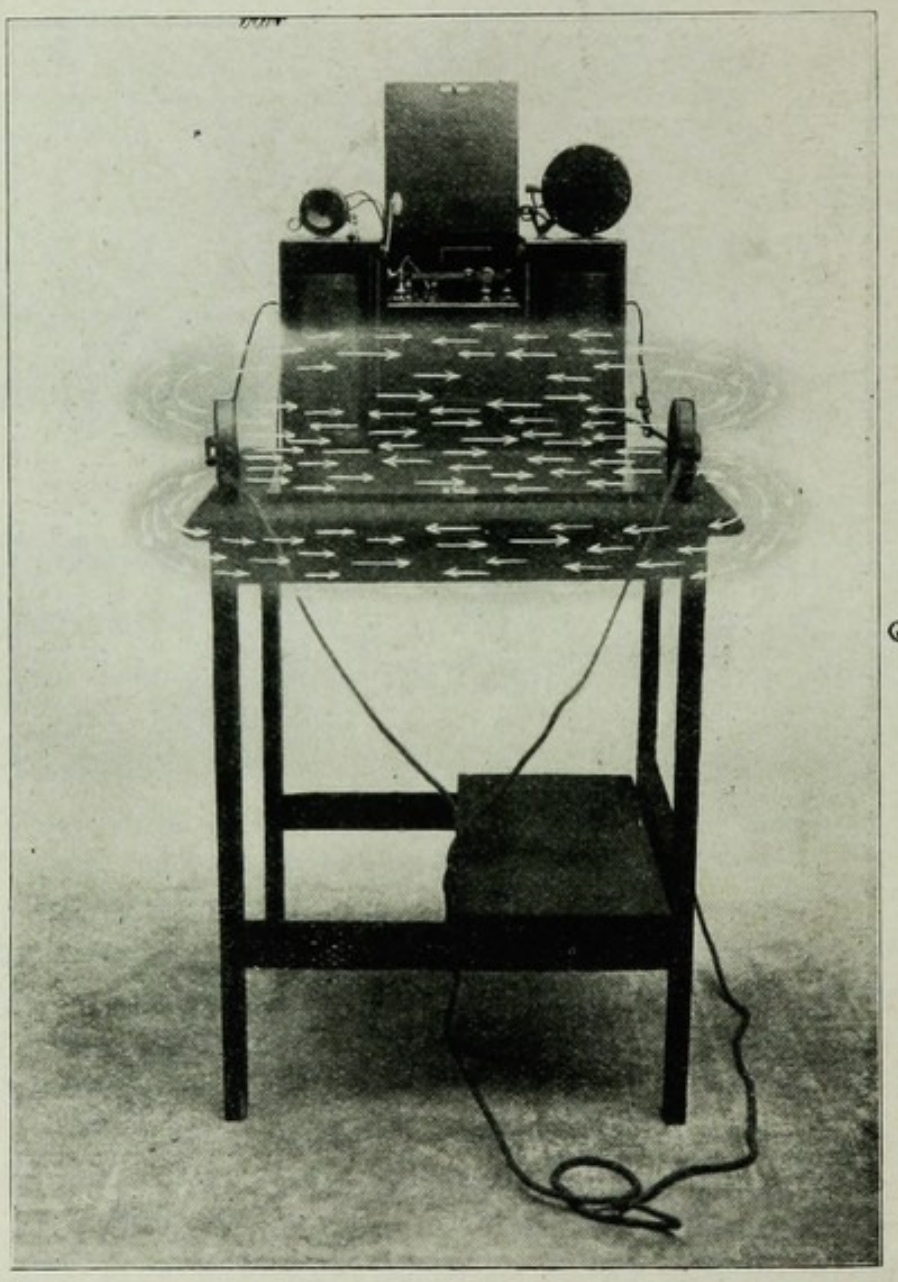
Listening to the action of magnetization by means of the microphone. Large outfit for street circuit.

Magnetization is the oldest and least understood and possibly the most valuable form of electrification.

We have discussed the magnetization of the blood and tissues of the body. The experiments of such eminent authorities, scientists, and physicists as Von Reichenbach and Cohn, of Berlin, and our own Atkins, of San Francisco, and Bachelet, of New York, have shown the fact that there exists within the human tissues the power of generation of a mode of electrification, to such an extent as to be registered by a meter. Bachelet made experiments on lower animals, by means of insulated needles, under anæsthesia, and Atkins corroborated the same with electrodes, introduced into the lungs of sheep, that there was a mode of electrification set up with each respiration, which would be shown by a meter attached to the wires from the electrodes used.

Bachelet experimented with nearly every organ of the body, and found that the greatest potential was generated in the lungs, probably on account of the excess of oxygen there, which, as we have shown, is very magnetic.

He also showed that no matter how long or how strong a mode of electrification was passed through the body, there was none of the energy held or stored, as it were. Consequently there was no increase of electric potential recorded by a meter. On the other hand, Bachelet has shown



The small magnetic wave apparatus energized by cells.

that when a living organism was immersed in a magnetic field, for a variable length of time, and then tested for the electric potential, it was shown to be augmented very much, the degree of augmentation being proportionate to the length of time and the strength of magnetic bath.

This fact undoubtedly goes far to prove the fact of the power of magnetization of the blood just the same as the magnetization of a bar of iron, which will retain the charge.

The results of the experiments and investigations of Bachelet, extending over a period of fourteen years, are summarized by him as follows:

1. That by no means which I could use or invent, could I, using the electric mode, increase the electrical potential of a living body.

2. That by placing a living body in a magnetic field, and permeating it with magnetic lines of force to the maximum of exposure, I could raise its electric potential as high as thirty-three per cent.

3. That the energy thus imparted to the living body did not depart from it, but transformed into vital energy, and was absorbed by and expended in the conduct of the vital processes.

4. That according to the average established by the series of experiments, the electrical potential of the living body, twenty-four hours after the treatment, showed an augmentation above the normal of twenty-five per cent.

5. That this augmentation, forty-eight hours after treatment, remained on the average, at nineteen per cent.

6. That upon the average, it was seventy-two hours before the stored energy was finally absorbed and converted, and the body returned to its normal potential.

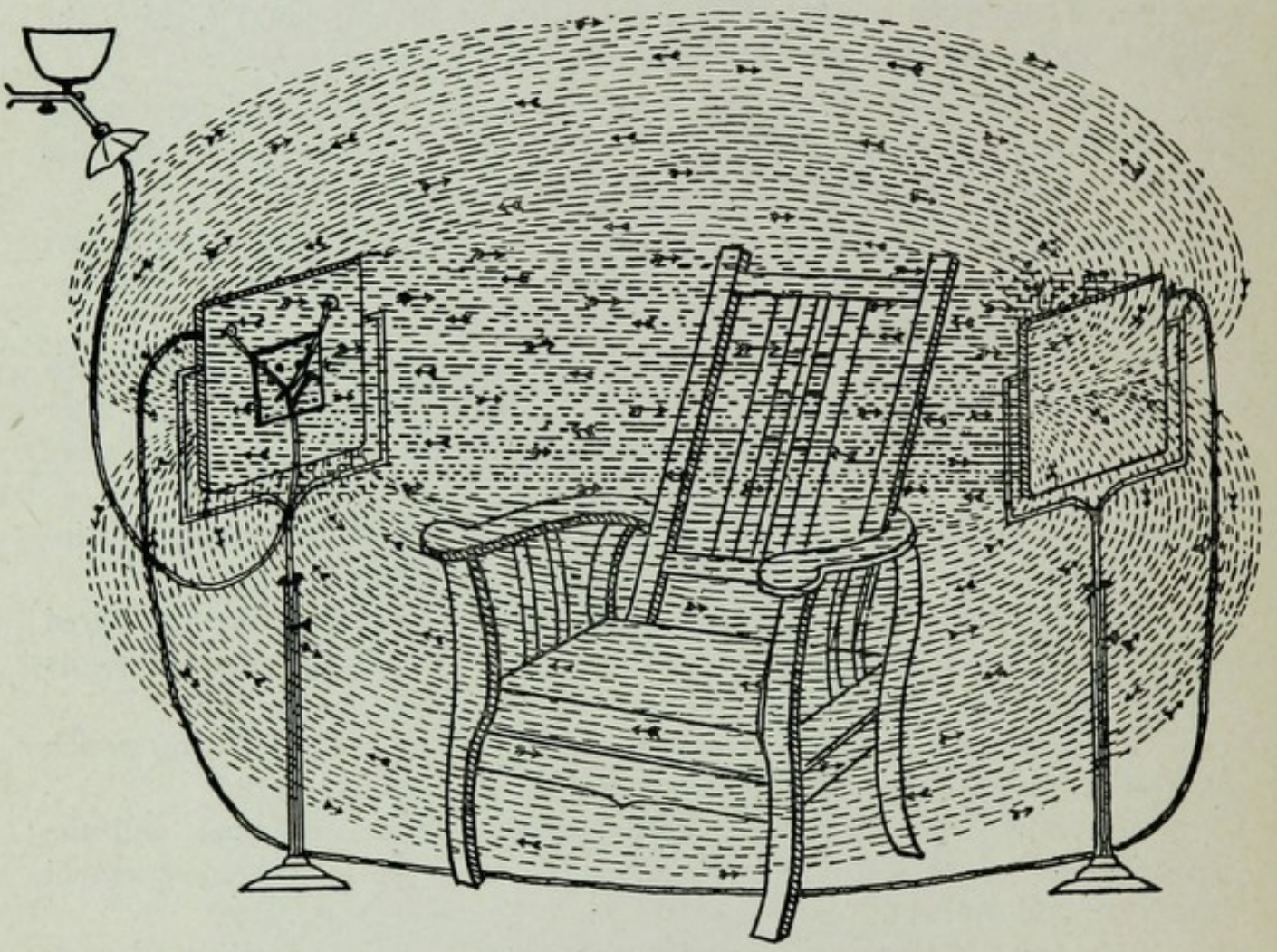
These records correspond approximately to the periods during which the magnetized oxygen in the blood retained its identity.

The importance of these records can hardly be estimated, and the great value of this form of treatment is apparent to the most casual observer and student.

The first invention of Bachelet along the line of magnetic waves, or lines of force, generators, was a clumsy six hundred pound affair, but the perfected instrument weighs but a few pounds, and is easily handled.

The perfected generator outfits are in two forms. A complete one in the photograph on page 319, shows the man standing between the generators, holding the detector between the two larger with the microphone to his ear. The large generators are 9 inches square and two inches thick, while the smaller pair are five inches square and one and a half inches thick. Both pair may be used together, or one pair separately, and all are attached to a switch board with a regulating rheostat and fuses. They are ready to be used when connected to the ordinary lamp socket on the A. C. circuit. If the D. C. only is available, a rotary convertor must be used to change the direct to the alternate mode.

The smaller outfit shown in the photograph on page 320 is on the same principle, but with smaller and round generators energized by cells, and is portable. In both photographs the field of magnetic influence is indicated by the white arrows.



The accompanying cut shows the two magnetic wave generators, connected to the source of electrification, and so placed and supported, that the chair, in which the patient sits, is directly within the most active field of influence, as is indicated by the straight lines of force, while the weaker field is represented by the curved lines of force. There is no appreciable sensation experienced by the person in the field, but that there is an influence being exerted, is demonstrated clinically by the cessation of the pain, and the prompt relief given. It may be more clearly demonstrated by means of a third one, held in the hand of the operator, to which is attached a microphone, similar to a telephone receiver, which the operator holds to his ear. This way the vibrations of the generators may be heard. In a recent test made in the laboratory of the National College

of Electro-Therapeutics, the waves were distinctly heard at a distance of six feet in every direction from the generator, and even through eight inches of a brick wall covered with plaster, and when the detector is held close to the generator, the sound is clearly heard all over the room.

What are the therapeutics of the waves?

The therapeutic effect of this method of magnetization is very marked, especially so in acutely painful conditions. I have seen, in my own family, relief given in a case of acute neuritis with this apparatus, which was more prompt and complete, than would have resulted from a hypodermic of morphine.

This opens up a great field of usefulness in the treatment of rheumatism and allied conditions, neuritis, neuralgia, neurasthenia and all states characterized by pain as a symptom. In all forms of inflammation and congestion as well as weakened and debilitated conditions, it has been shown of great value. In paralysis and mental troubles, as well as kidney and other glandular diseases, and even in tuberculosis, it has given surprising results.

Convalescence is hastened, and the prostration following the strenuous life is combated by magnetization.

It is not a stimulant, and carries with it no deleterious reaction, but simply supplies the weakened body with the vitality it needs, in such quantities as the condition demands, so that as the cure proceeds the patient needs less strong and frequent treatments.

The action is so direct and immediate, that a too strong or long treatment, in a chronic case, may set up such a decided movement toward the normal as to cause a marked disturbance. Therefore the generators are arranged as to regulate the effect desired.

As in all forms of treatment, frequent and mild applications, so as to get the slow and cumulative effects, are best. The effect on the pulse and temperature is marked, the tendency being to restore the balance in either, whether they be too high or too low, though sometimes in a fever, there is a slight increase of the temperature, before a recession to the normal.

What is the physiologic action of magnetization?

We know that the dynamic form of electrification, by which we may generate magnetization, is easily insulated, and we also know by the law of Ohm that the most of our energy is expended or used up or wasted, before it can get through the skin, and even then its effect is such that its time of

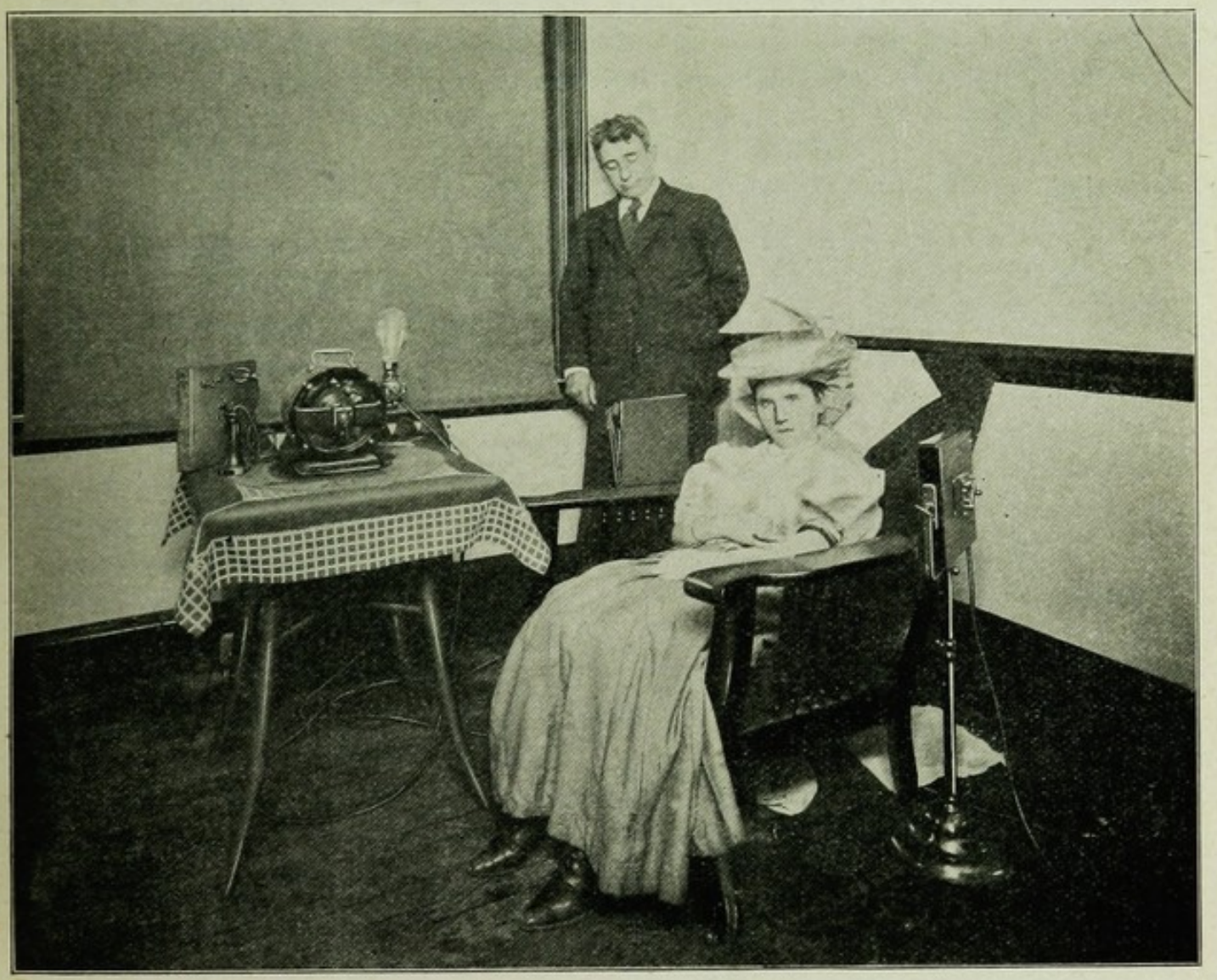
action is limited, and we also know that magnetization is not hampered by this drawback, and cannot be insulated, but will permeate every tissue thoroughly and instantly, without loss of power, and when we see by these experiments that there remains long afterward, an effect, we see at once the almost inestimable value and importance of magnetization as a therapeutic agent.



It is evident that a sick or deranged body, or part, when placed in this field of potent influence, will be greatly aided in its endeavor to throw off the disease, and resume the normal state of equilibrium. Of course we must all accept the axiom, that nature is always trying to regain or keep its balance.

There is no appreciable sensation experienced by the person in the field, but that there is an influence being exerted, is demonstrated clinically by the cessation of the pain and the prompt relief given.

The well known and widely advertised case of spasm of the diaphragm or persistent hiccough, which puzzled and baffled the whole medical fraternity so long, was undoubtedly cured by this method of treatment. This was a case of a fifteen year old girl, who hiccoughed on an average of eighty-nine times every half hour during her waking hours, for a period of over ten months, and which yielded to nothing, until treated by magnetization.



The accompanying half tone from an actual photograph of the case, shows the hiccough girl being treated, and demonstrates the simplicity of the method.

In all cases the point of sufficiency of the treatment is manifested by a sense of congestion and frontal headache, which is harmless in itself, but is a good index when to stop, as being proof that enough has been given for the present.

HOW TO APPRECIATE MAGNETIZATION

The action of the magnetization is appreciable by at least three of the special senses, feeling, sight and hearing. For this purpose the detector is used, and held midway between the generators in the most active field. If the pair of ordinary metal handle electrodes be connected by a pair of cords to the detector we may feel the induced magnetic mode in our hands. If an incandescent lamp is connected to the detector, the lamp will light up brilliantly. If the microphone is attached to the detector, it will hum or buzz according to the strength of the field so that it may be clearly heard all over the room.

TECHNIQUE OF THE WAVE GENERATORS

The wave generators are used thus:—The patient is seated with one standard and pair of generators in front and the other behind, or they may be placed on either side. One small generator is placed close to the frontal sinus, so as to reach the optic area. The other small generator is placed close to the base of the brain so as to include the medulla, and cervical sympathetic area. This pair will promote cerebral activity. One large generator is placed in front of the solar plexus. The other close behind the lumbar and genito-urinary centers. These will stimulate activity in the abdominal brain, and normalize the visceral functions, and when applications are properly localized there is an action upon the nervous system which is corrective of many degenerative conditions.

If necessary, for a more decided effect, the generators may be taken from their supports, and placed directly in contact with the part to be treated.

The action of the magnetization upon the nervous centers is very decided. This is especially manifested in their power to lessen or prevent surgical shock. This is well demonstrated in the practice of Dr. A. B. Gloninger of Lebanon, Pa., who makes it a practice in his hospital work in surgical cases, to place the wave generators under the arms on each side of the body of the patient and keep them in action before, during and after a surgical operation, thus greatly lessening and usually preventing surgical shock.

Of what value is magneto-therapeutics?

From a total of 50,000 treatments of all sorts, upon all kinds of patients, without any attempt at selection, and with applications sometimes

lasting for hours, and though some cases continued for months, the conclusions are, that the applications are in the main beneficial, and that in the hands of a careful, prudent practician, the apparatus is entirely harmless.

Magnetization is best in conditions of low vitality, with a sub-normal temperature, and insufficient oxidation of the blood, marked by poor circulation, anæmia, and therefore where coldness persists. The results in many cases of rheumatism are most excellent, even in some of the most obstinate forms, and if used for nothing else, would be a great boon to humanity. Among other painful conditions which were relieved were those of floating kidney, chronic cystitis, neuralgias, headaches, dental caries, phthisis, rheumatism, gout, and it was found very useful in hastening convalescence.

The technique of the applications is extremely simple, and the apparatus cannot get out of order. All that is necessary is to attach the solenoid to a twin cable with a plug, which is screwed into a lamp socket, and the mode turned on, either by the usual thumb snap, or better by a knife switch, and immerse the body or part in the magnetic field.

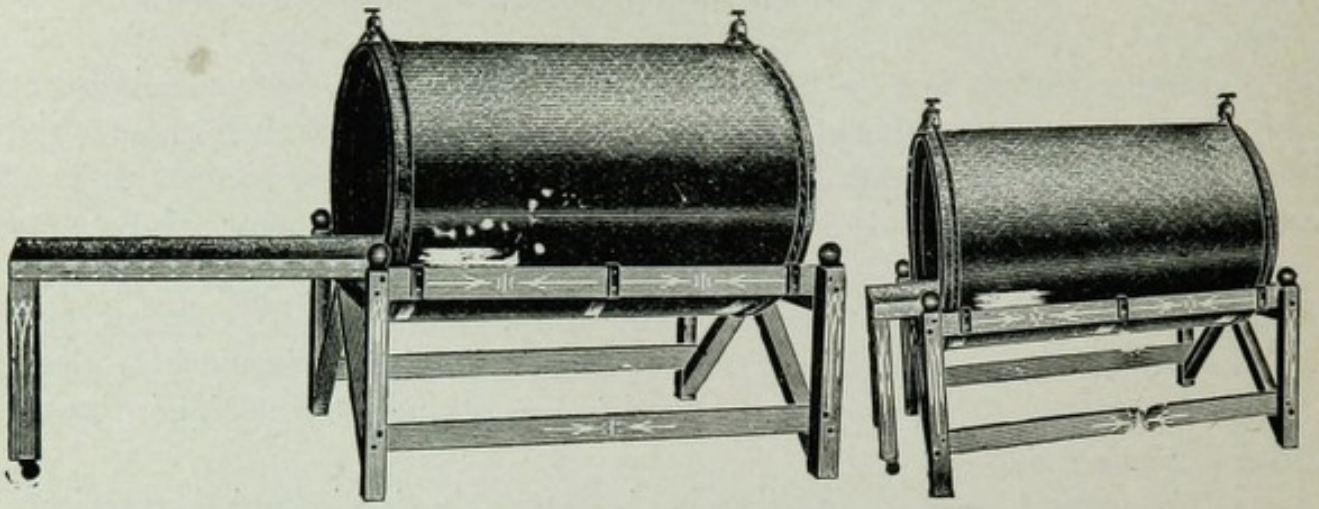
The main features of this agency may be summarized as follows: rhythmic-motion and reciprocal "ion" action of a penetrating magnetic flux which adjusts itself to the vital impulses without shock or sensation, and so rigid and inseparable that it passes through everything, and so subtle that it leaves no apparent mark in its path, and yet so flexible that the human body can pass through its most intensified field of action without any manifestation of resistance, and during its application through the "optic area," the most sensitive organization of the eye does not experience sufficient sensation to cause a quiver, and thus while it seemingly has no influence at all, it imparts a most powerful action in microscopic detail toward the restoration of natural function in the treatment of a wide range of disease.

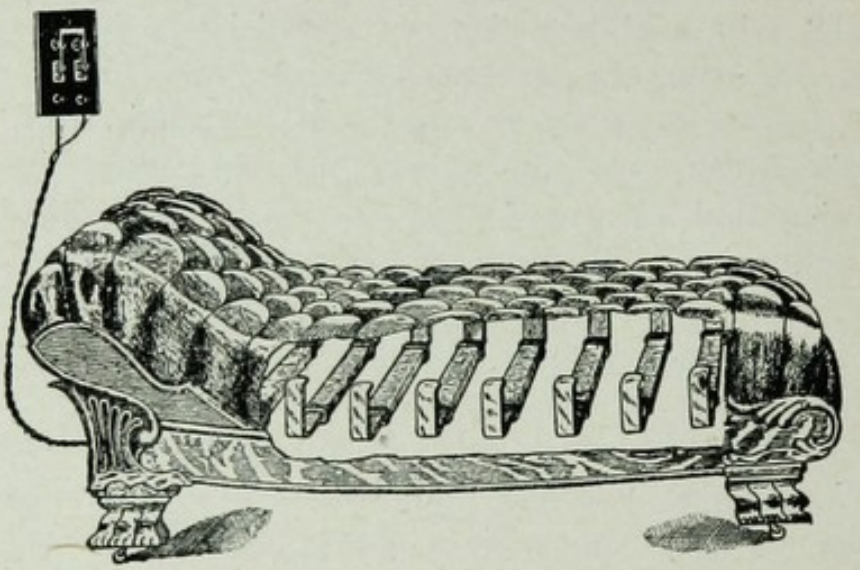
This modality is yet in the formative or experimental stage, and of course the treatments are largely empirical, but that is nothing against the method, because, after thousands of years of practice of drug medication, medicine is still largely empirical, and guess work. There is a glorious future for electro- and magneto-therapy in conjunction with other physiologic or natural remedies.

THE BODY MAGNETONE

The cuts on page 328, show the body magnetone for immersion of the trunk in the alternated electro-magnetic field. The platform is pulled out,

the patient lies down, and the platform and body is pushed into the tube and saturated with the electro-magnetization.





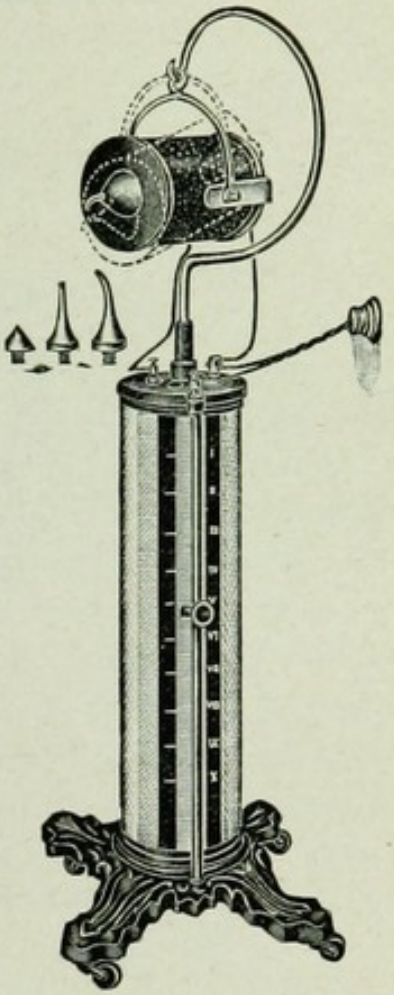
What is the magnetic couch?

The above cut shows another adaptation of the electro-magnetic field for the treatment of disease. This consists of an ordinary tufted leather couch, concealed in which are a number of heavy horse shoe magnets, bent into a wide and shallow curve, and so arranged that when the patient reclines above them, his body sinks down so that when the mode is turned on he is traversed laterally by the electro-magnetic fields between the poles of the different electro-magnets in the row. To get the effect longitudinally through the body or part, it must be placed transversely across the couch. This is an ornamental instrument, as well as useful, and is very refreshing to the patient, after the exertion of a walk or other treatment or operation, which has irritated the nervous system. It will be found especially useful after gynecological operations and treatments.

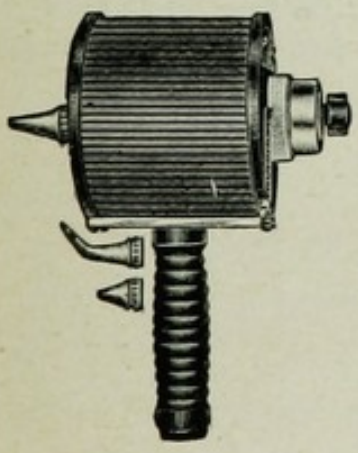
ALTERNATING AND DIRECT ELECTRO-MAGNETS FOR EYE WORK

While on the subject of magnets it may be well to call attention to the use of them in eye work, for the removal of particles of magnetic iron or steel from the eye.

The cut at the right shows a reduced illustration of the giant eye magnet, for use in hospitals and by ophthalmic specialists, desiring a very powerful magnet in their work. This exerts an enormous power of attraction, and is capable of sustaining several times its own weight. It is mounted on a heavy base with an adjustable crane, and swings in a universal swivel, which adapts it to any height or angle and while heavy, is easily handled. They have several interchangeable tips, and are wound to suit the different modes.

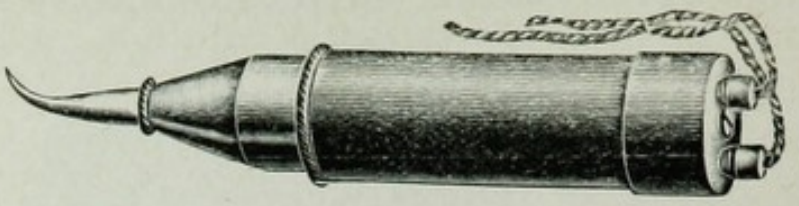


Many still labor under the mistaken impression that eye magnets cannot be operated with the alternated mode, but they are so made now as to be used with either mode. This magnet is mounted on a revolving swivel arm and may be used in any position. It also has a controller regulating the pull. It weighs 150 pounds and is very powerful, and has various tips adapted to different uses.



HAAB HAND EYE MAGNET

Weight 35 lbs. for direct or alternating mode, with controller and rectifier is suited for work requiring less strength than the large magnet and is a valuable aid to the oculist.



Eye Magnet with 3 tips for removing iron or steel from the eye.



The accompanying two cuts show a small eye magnet, which may be used in connection with a small acid battery or a few dry cells, and which will develop sufficient power to enable the skillful operator to successfully remove magnetic particles from the chambers and coats of the eye ball. The magnet is small and compact and inexpensive, and will fill a long felt want of the general practician. The large cut will explain the technique of its use. For this purpose a constant mode with a steady pull is desired.

PHOTO-THERAPY

What is photo-therapy?

Photo-therapy means the therapeutic application of light from any source, and may be the light of the sun, or the light derived from any artificial source, such as the electric arc, or the common incandescent lamp or the light emitted from the vacuum tube, the X-ray, or the so-called ultra-violet light, or the white light passed through various colored media.

What is the physiology of light?

Physiological experimentation has developed the facts that light has a decided influence on the tissues and processes of the human economy, increasing the oxidation of the cells and augmenting the amount of hæmoglobin in the blood, and stimulating the absorption of waste matter, and hastening the reparative function.

What is the therapy of light?

Therapeutically we may recognize three distinct effects which are due to the activity of one or the other part of the spectrum. Some of the rays produce *heat,* especially those emanating from the red field of the spectrum. Other rays, especially the green are essentially *light*-producers. There are other effects which are principally due to the activity of the so-called *chemical* field of the spectrum. These are the violet rays and more particularly the invisible rays which lie *beyond* the violet and are, therefore, known as the *ultra-violet* rays. To recapitulate: we speak of heat-rays, light-rays and chemical-rays. Photo-therapeutic methods depend upon the characteristic action of these rays. Some of these methods are dependent upon the capability of certain rays to produce heat, light or certain chemical effects. At times a conjoint effect, combining the action of light and heat, is aimed at.

What is chromo-therapy?

The use of colored lights in therapeutics is called chromo-therapy.

For several years past the therapeutics of light and color have been a very interesting department of medical therapeutics. It should be better known to more physicians and a great deal more would be accomplished in the treatment of various conditions, especially sub-acute and chronic diseases.

What physiologic effects have the colored lights?

The red is warming, and especially stimulating to the arterial blood, and desirable in cold, pale or bluish conditions. It is contra-indicated in inflammatory and over excited conditions.

The yellow, aided by some red (yellow-orange), is animating to the nerves, being laxative, diuretic stimulating to the brain, liver, etc., and especially desirable in constipated, paralytic and stupid conditions. It is contra-indicated in delirium, diarrhœa, etc.

The blue, indigo and violet, being cooling and constricting, are nervine, astringent, refrigerant, antiseptic, febrifuge, anti-inflammatory, narcotic and anti-spasmodic. They are contra-indicated in cold, bluish and chronic conditions unless considerable excitability is present.

The green is mainly cooling and much like the blue, as strained through ordinary green glass, though the yellow part of green gives nerve stimulus, good for uterine inflammations, etc. The green may often be used to an advantage over the small of the back and lower spine in cases of over sexual warmth and seminal emissions.

The purple combines the blood warming red and the cooling antiseptic blue and is excellent for the lungs, stomach and other parts where animation without irritation is needed. Red-purple is good for a dormant stomach, but blue-purple is best if stomach is not hot and excitable.

The orange arouses both nerves and blood.

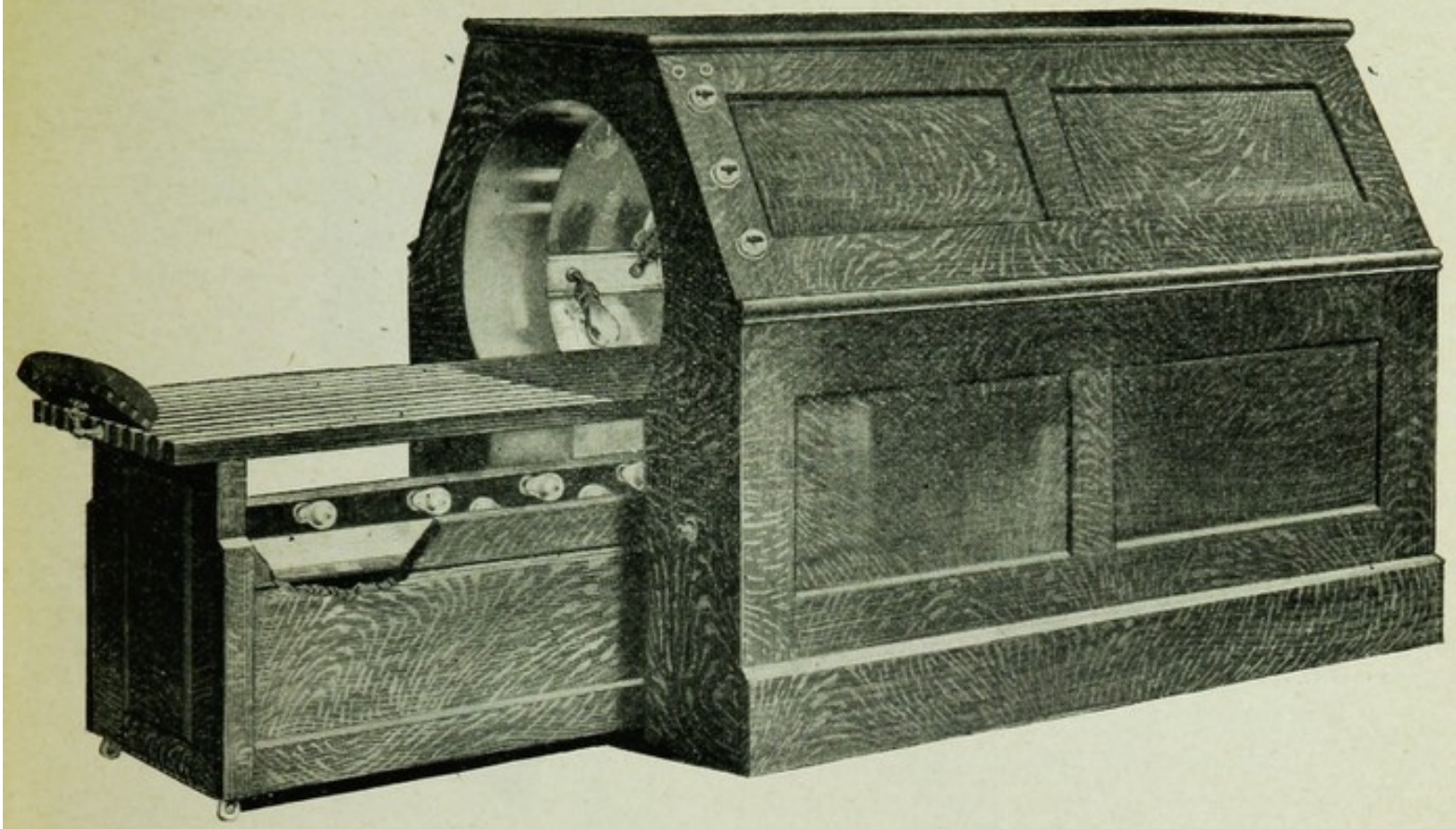
These colors are usually applied externally to the bare body by means of colored panes of glass.

No intelligent physician can dispute the great value of colors in therapeutics. It is a department of therapeutics that is of great value and should receive further attention.

The violet rays of electric light are said by Minin to be anæsthetic and antiseptic at the same time.

CARLSBAD ELECTRIC LIGHT BATH CABINET

One that allows the patient to lie down and rest while taking treatment. It is the latest European model. Does not require as many lamps, hence costs less to operate. Made from the best kiln dried quarter sawed oak.



The car the patient lies on with head rest is 76 inches long, has electric lights and French plate mirrors the full length under the rack the patient lies on.

Sides, top and end of the cabinet are also covered with the finest quality heavy French crystal plate mirrors. There are 36 lamps of 32 c. p. each, each set of 6 controlled by a separate switch from the outside.

The car is mounted on ball bearing castors.

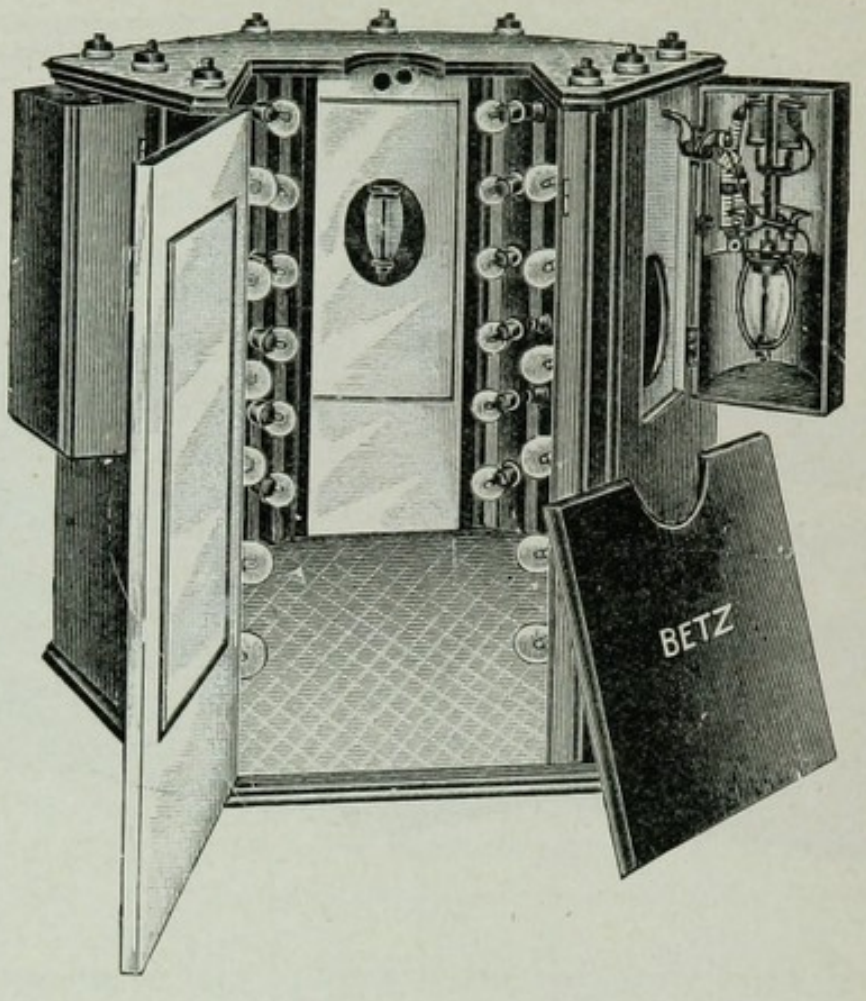
On account of being able to rest, patients prefer this cabinet; the head being outside they breathe the fresh air instead of the impurities thrown off the body as in the old style Turkish and Russian baths.

KING EDWARD ELECTRIC LIGHT BATH CABINET

With incandescent and violet ray arc lamps if desired.

Made of heavy golden oak, highly polished with 36-32 c. p. and 3 special 4000 c. p. violet ray arc lamps, lined on all sides with the best quality heavy French crystal plate mirrors or finished white enamel with large reflectors which throw the light directly on the patient.

Each set of lamps is controlled by a separate switch. Any number of sets can be thrown on or off as desired.



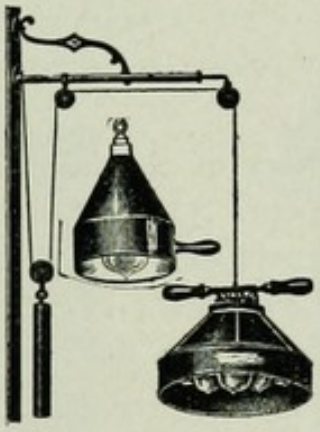
We always recommend the cabinets lined with French mirrors because the extra cost is small compared with the fine appearance mirrors have over white enamel and it is claimed the results are better. Stands 51 inches high, 48 wide.

What is the technique of the light bath?

The patient is prepared as he should be for an ordinary tub bath, door of cabinet, which is in the side of same, opened, patient seated on a stool in the center of the cabinet, arranged so it may be raised or lowered, to suit the stature of individual. Patient sits or lies facing long axis of cabinet, thus allowing a bombardment of light vibration in all directions. Your door is then closed, and top opening also covered with a crash cloth, which is tucked snugly around the patient's neck permitting only his head to protrude, upon which a towel is placed, which has been previously wrung out of ice water. He remains in the cabinet from twenty (20) to thirty (30) minutes. Your patient remains practically cool, yet perspires profusely, which is not at all disagreeable, but on the contrary produces an indescribable glow, which is rather pleasurable than otherwise.

By reason of previously stated arrangements of lamp and carbons, which is demonstrated by a thermometer being placed in the interior of the cabinet, in a room whose average temperature is 65 degrees, it is shown that the cabinet is never warmer than 85 degrees, fully establishing the fact that the reaction produced from the vibration of light, acting on cell life, produces untold elimination, one of the prime factors necessary in the treatment of all toxic conditions.

This technique of proceeding with our patient is what I have designated SYSTEMIC treatment. After patient is removed from cabinet he is treated just as he would be if coming from a tub bath, permitted to have a nap, which is usually in demand, and while this is being gone through with, if there is any hepatic engorgement, or any other local condition, which needs attention, with a third lamp, same as ones employed in the cabinet, suspended from ceiling, we proceed to bombard condition demanding our attention. The latter process cannot as a rule be kept up with the liver more than eight or ten days, as the phenomena of bile salts so assert themselves, as to render a day or two of rest imperative. All other conditions may be treated locally until well, without inconvenience.



I might here add that the ceiling lamp used for local treatment has a shield and reflector attached, which intensifies the vibrations.

For what is the electric light bath used?

This form of electrification has given most gratifying results, especially so in the treatment of the following diseases: Eczema, tuberculosis pulmonalis, lupus, acne, psoriasis, rheumatism, all forms, especially acute and gonorrheal types, constipation, arthritis deformans, malaria, hepatic troubles of all forms, stomachic disorders, neurasthenic conditions, very sedative to all forms of functional and valvular disorders, correcting them as far as it is possible for them to be corrected, and syphilis. Experience in the treatment of the last mentioned disease hasn't been sufficient to war-

rant stating anything absolutely definite, further than the beneficent results or action obtained in other conditions would promise good results in this most formidable disease.

Dr. Crothers, of Hartford, Conn., who has had considerable experience in the use of the electric light bath, as an aid to the treatment of alcoholism and drug addictions, considers that the sudorific effect produced by the electric light bath is superior to that produced by hot air, both as to rapidity of action and duration of effect, and is useful as a remedy for the restoration of deranged metabolism, which is manifest in these cases.

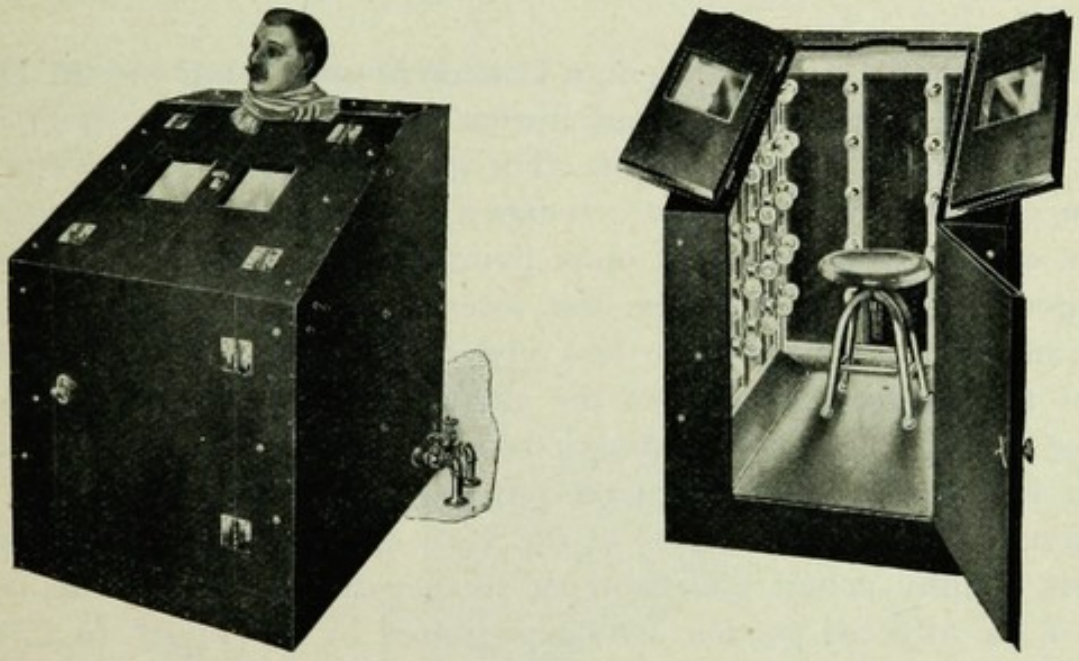
The patients treated by him, like all of their class, suffered from various insanities, along with other disorders among which may be mentioned sclerotic conditions of the heart, liver, kidney and blood vessels—particularly of the smaller arterioles. With these pathologic changes there were also vaso-motor paralyses, muscular paralyses, anæmia and neurasthenia.

Results other than those noted may also be produced. In tobacco heart, so-called, the tachycardia and arrhythmia are both corrected to a great extent, and even in cases of irregularity of heart action due to organic disease improvement is shown by greater regularity and steadiness of action.

The insomnia usual in cases of the kind under consideration is generally overcome by this treatment. Other conditions found to be improved by it are neuritis, gastritis myalgia, nervous irritation, arterio-sclerosis and sclerosis of the liver and kidneys. There is also noted a marked tendency in those taking the baths to lose their appetites for spirits.

Kellogg summarizes the therapeutic effects and modes of application of the incandescent light bath as follows: 1. General and local revulsive, effects, by dilating the cutaneous vessels. The reddening of the skin begins within a few moments and becomes more and more intense as the application is continued. The permanency of the effect may be increased by a short cold application following the light bath. 2. Sudorific. It induces perspiration more quickly and more vigorously than any other agent, and with the least amount of inconvenience and discomfort. Care must be taken to protect the heart and the head by means of cold compresses. The patient should be made to drink water very copiously, both to encourage diaphoresis and to maintain the normal blood volume. 3. Promoting the absorption of exudates. Both general and local applications are valuable. In France the general electric light bath has been used successfully in promoting the absorption of exudates in the cornea

of the eye, vitreous opacities and similar pathologic products. Kellogg has used with success in promoting the absorption of exudates from the pleural and peritoneal cavities, and in and about the joints, general applications of the electric light bath, combined with local applications of the light to the affected parts, and suitable hydriatic measures. A cooling bath is necessary after local applications to the joints, this to be followed by the application of a heating compress. The local application of light should be made at least twice daily, the general application once a day. The heating compress should be changed at least twice daily. Massage and, in some instances, electric applications to the parts, and especially to the adjacent muscles, are important adjuvants. 4. Tonic effects. No other means excels short applications of the incandescent electric light (three to eight minutes). A sensation of well-being, similar to that experienced by one who stands before a glowing fire, is pronounced, and when followed by a proper hydriatric application, the stimulation to nutrition is of the highest possible degree.



STEAM, HOT WATER OR ELECTRIC LIGHT CABINET

Made of steel and crystal plate mirrors with false bottoms to be connected direct to steam or hot water pipes, or steam and electric light or hot water and electric light.

The object of operating these cabinets with a steam coil in the false bottom and the heating coil in the back is for the purpose of being able to give the Turkish and Russian bath at the same time. The perforated steam pipes in the false bottom of the cabinet are controlled either by the party taking the bath or by the attendant on the outside.

When operated by electric light and steam or hot water it costs but little to treat each patient.

What are ultra-violet rays?

Let it be remembered once for all that the term "ultra-violet" does not refer to any special color. The term designates the location of the rays which bear this name. An *ultra-violet* ray is a ray whose spectroscopic location is *beyond* the violet field of the solar or arc-light spectrum. The ultra-violet rays belong to the variety of chemical or actinic rays. They are invisible and, therefore colorless.

What can be done with the Finsen and Dermo light?

The very great popularity of the Finsen treatment is shown by the large number of London hospital lamps and Dermo lamps which have been installed by physicians in all parts of the country. The two Finsen lamps named are without a doubt the best, most convenient and yet most serviceable modifications of the original cumbersome device with which Finsen made his clinical experiments.

There are a number of modifications of this lamp known as the Scholtz or Triplet, the Bang or Dermo, and the London lamp.

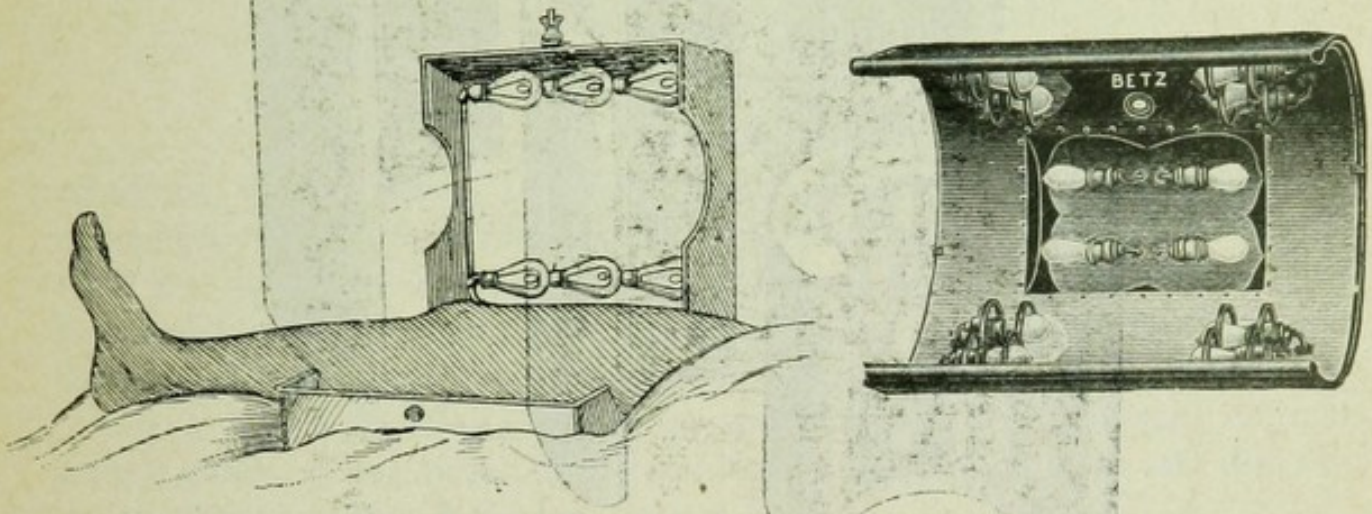
Dr. Juettner of Cincinnati, has answered the question and summarizes as follows:

What can be accomplished with a London hospital lamp and the Dermo lamp, the two best modifications of Finsen's original device? Both lamps produce a wealth of chemical light. The germ-killing power of this light has been proven beyond a doubt. It has a strong affinity for oxygen. It produces a disintegrating effect upon living tissues. The greater the resisting power of the tissues, the less intense the action of the chemical rays. Since morbid tissues are less viable than normal, the destructive effect of the chemical rays upon the cutaneous tissues wherein tubercle-bacilli or other germs have found lodgment, can be readily understood. Lupus is the classical example of the physiological action of Finsen's rays. Their germ-killing power strikes at the very essence of the affliction. It stimulates healthy action by attracting oxygen to the part. The morbid tissues of the afflicted portion are disintegrated by the rays. In this way a healthy reaction is set up which tends toward restoration of normal conditions.

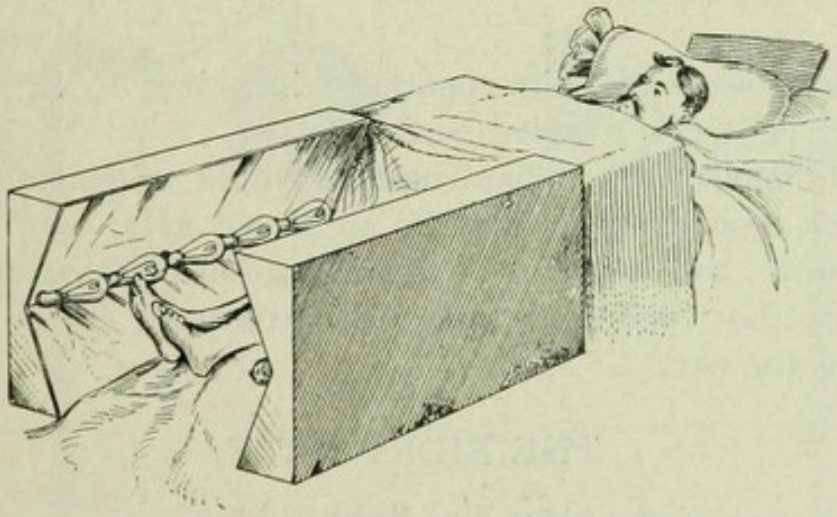
Applications should be as close to the affected area as possible and should last ten minutes and longer. The average duration of a treatment is thirty minutes. The light from the Dermo lamp is rather more concentrated and, therefore, stronger. The conditions in which these lamps can be advantageously employed are lupus, acne, herpes, tinea circinata, sycosis, wine-marks and many other skin troubles in which an alterant and germicidal effect is desired.

Alternate applications of X-rays and Finsen-rays have been put to several practical tests in the clinic of the "Cincinnati-Post-graduate School of Physiological Therapeutics," by Dr. Juettner. There can be no doubt about the value of the combined treatment, especially in cases of epithelioma, indolent ulcer, etc. The results are prompter than after the use of either the X-rays or the Finsen-rays alone.

Of what use is the localized light bath?

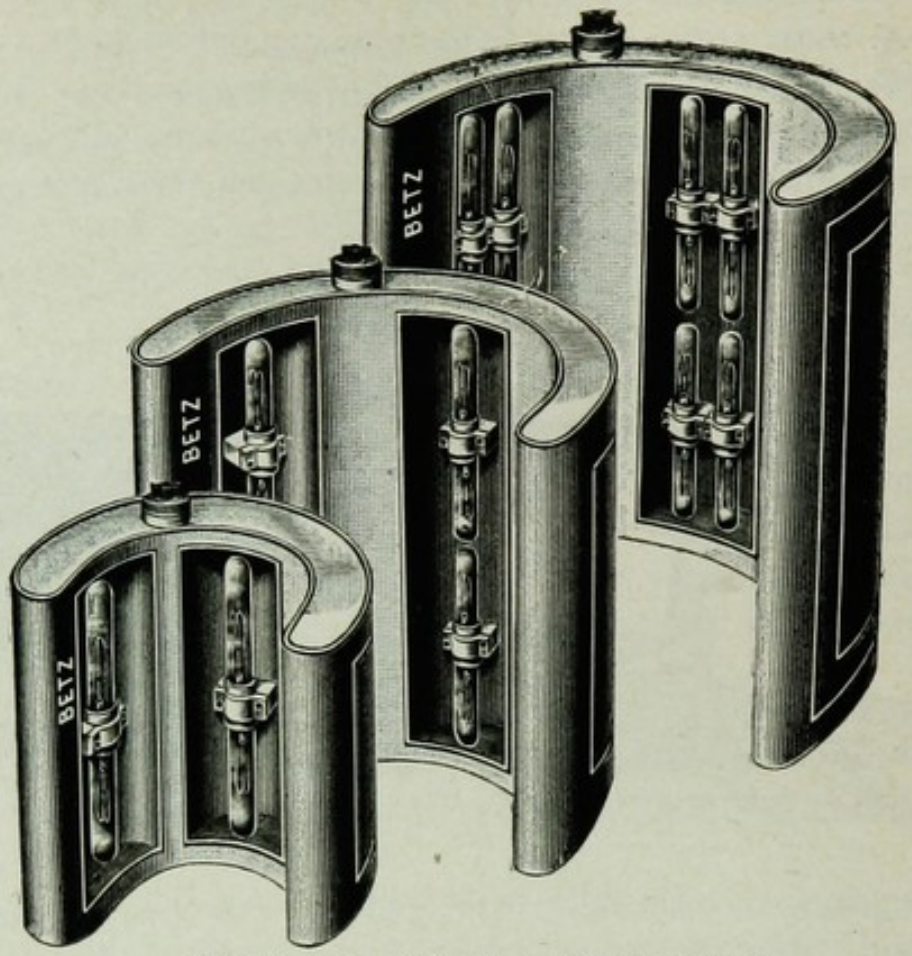


The cut shows a local light bath applied to the leg, the leg resting in the lower half, while the hinged upper part is raised. After the part is in position, the upper half is let down closing in the part to be treated.



A PORTABLE LIGHT BATH

The cut shows a portable electric light cabinet bath, which may be taken to the bed of the patient, and applied there. The illustration shows the manner of its use, the two sides with the row of lamp bulbs and reflectors being placed on either side, and the whole covered with the bed clothing, so as to retain the heat.



BODY AND LIMB LIGHT BATH
English model with double air chambers. Long tubular lamps, set back out of the way. Made of cold rolled re-tinned copper.

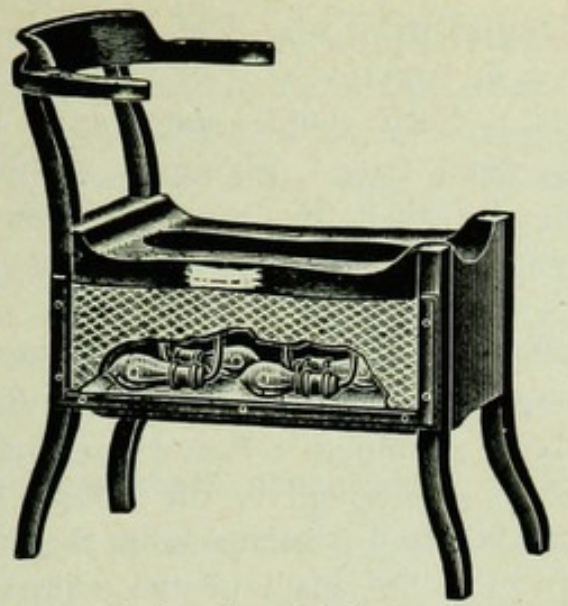
The cuts show local light apparatus, intending to be applied to the back, abdomen or other rounded surface.

With this appliance a radiant heat and light treatment may be given to any surface desired. This may be so placed as to form an arch over a part, as a knee, and is useful in treating sprains, dislocations, fractures, synovitis, and other conditions, where the part must not be moved, without disturbing the part.

THE BIDET BATH

What are the uses of the bidet sitz light chair?

The cut shows the bidet or chair bath, in the form of a box stool, with a back and arms. This is arranged with six lamps, and with mirrors in the floor which give both a radiated and reflected heat and light application. This form of local bath is especially good for the treatment of disorders of menstruation, such as amenorrhœa, dysmenorrhœa, vaginitis, and for ovarian and other gynecologic troubles, also for rectal and genito-urinary

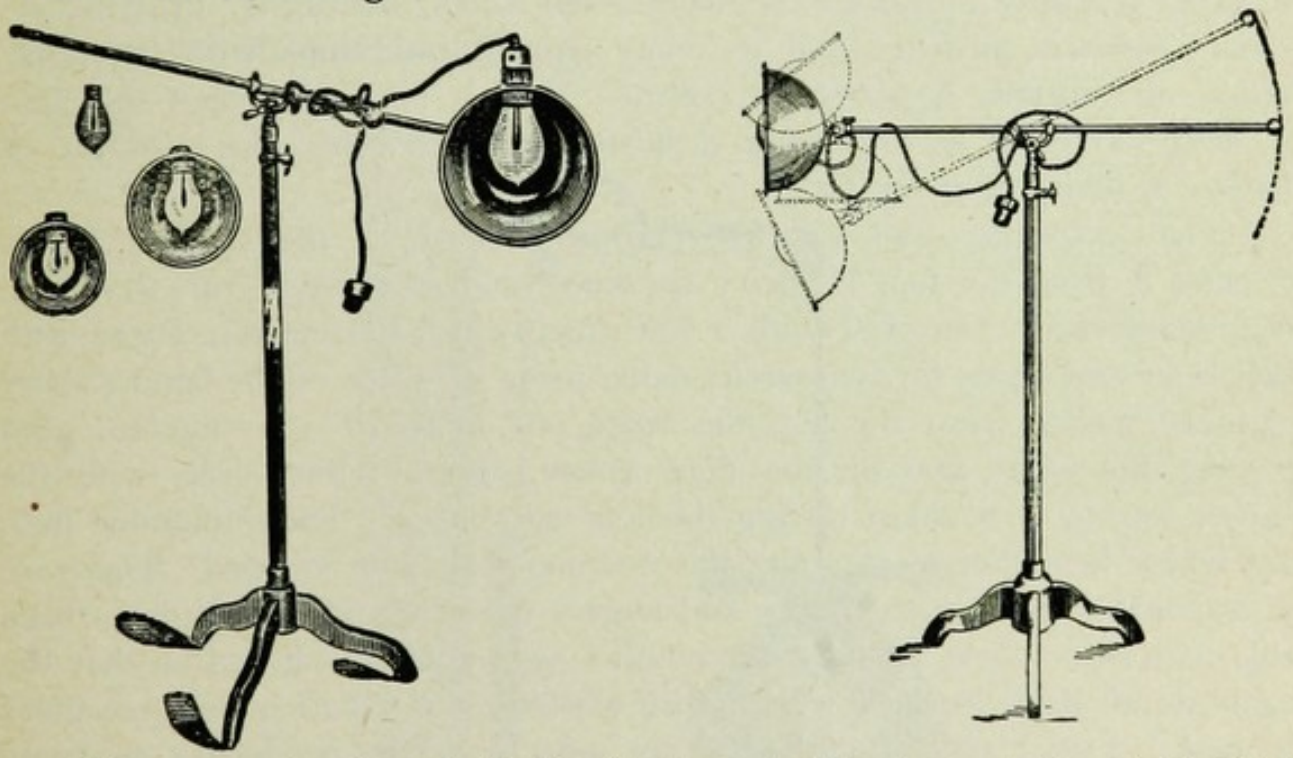


affections, in both sexes, and local pruritis and eczematous skin eruptions, characterized by inflammation, pain and exudate. In all of these conditions the local use of the electric bidet bath will greatly assist in the restoration of the normal condition, by equalizing the circulation and relieving the pain and itching, when all other forms of treatment fail.

It is especially adapted to the treatment of scanty or delayed virginal menstruation, where other local examinations, or applications, are for obvious reasons, contra-indicated, or not desirable.

THE MININ OUTFIT

What is the Minin light outfit?



The two cuts show both the front and side view of the violet light outfit as devised and used by Prof. Minin, of St. Petersburg, and as made

by an American manufacturer, who has secured from Dr. Minin the exclusive control of it in America.

The outfit which is very simple consists of an upright standard, mounted on a heavy metal tripod, giving it stability. The standard is double, one telescoping the other, thus giving considerable range of height, to the top of which another rod is attached by means of a double clamp and swivel joint.

On one end is a ball and socket universal joint, holding the different reflectors. This arrangement gives any position that may be necessary. There are three parabolic aluminum reflectors polished inside like mirrors, and of different sizes to correspond to the different lamps used. These lamps are of the usual shape of incandescent bulbs, are 16, 32 and 50 candle power respectively. The glass of these three lamps is of a deep violet color, which gives them the name of violet light.

What can be done with the Minin light?

Prof. Minin, of St. Petersburg, after many years of experimenting, has demonstrated theoretically and practically that with the *ultra-violet rays produced by his special apparatus, better results can be obtained in a shorter time than by the Finsen method without any of the unpleasant after effects so common after Finsen treatments.*

We have used it for the relief of pain in the eyes, head and joints, articular and muscular rheumatism, arthritis deformans, gout, sprains, bruises, fractures, dislocations, ulcers, old sores, neuralgia, neuritis, eczema, psoriasis, pruritis, and in many painful conditions with invariable relief, and usually a permanent result. It is a fact that when the light is held too close it will cause a blister without either the operator or patient realizing it at the time.

One extremely bad case of chronic eczema of the leg completely circling it from the foot to above the knee, and of several years standing, was wonderfully improved with a few treatments, and entirely cured with half hour exposures for two weeks daily, using all three of the lamps, about eighteen inches from the leg, the large one above in the standard, and placing the other two on the floor below, and at either side, with the patient sitting on a chair, resting the foot on a stool. The intolerable itching which kept him awake, and the weeping was soon stopped. One case of arthritic trouble in the hands and fingers where the woman had not been able to write or sew or drive for months, was quickly relieved so that she could do all three in three weeks, with exposures of a half hour three times a week. I was severely jolted in an auto accident, producing an acute neuritis in the entire right brachial plexus causing an intense pain for

several months, and the only thing to afford relief, except opiates, and I tried every other form of electrification and vibration, without any but temporary relief, was daily exposures to the strongest Minin light for an hour each night after retiring. After such a treatment I could sleep all night, without it I could not sleep at all. About ten treatments in two months cured the trouble.

What are some nervous diseases benefited by violet light?

Neuritis, neuralgia, sciatica, migraine, tic, zoster, etc.

What are some painful diseases benefited by violet light?

Carbuncle, abscess, sprains, orchitis, burns, fractures, ulcerated teeth, pleurisy, bronchitis, cystitis, rheumatism, etc.

What are some cutaneous diseases benefited by violet light?

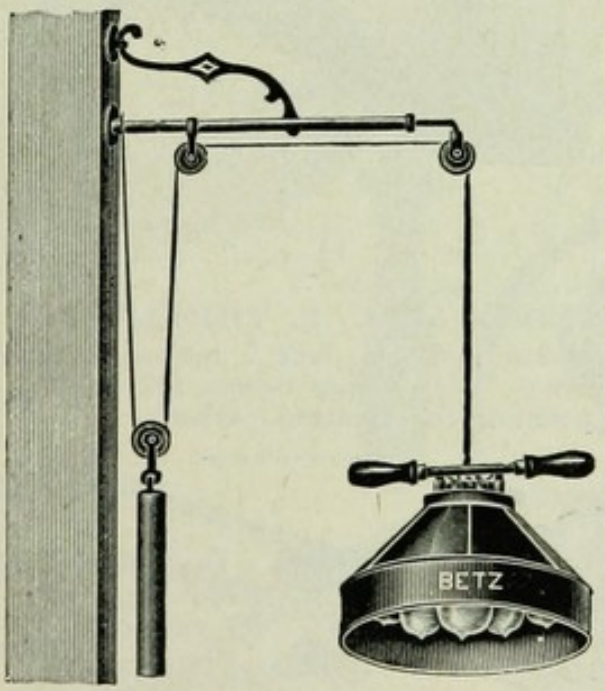
Eczema, chancroid, varicose veins and ulcers, dermatitis, and X-ray burns, boils, and as a local anæsthesia for operations on the surface.

What are some malignant diseases benefited by violet light?

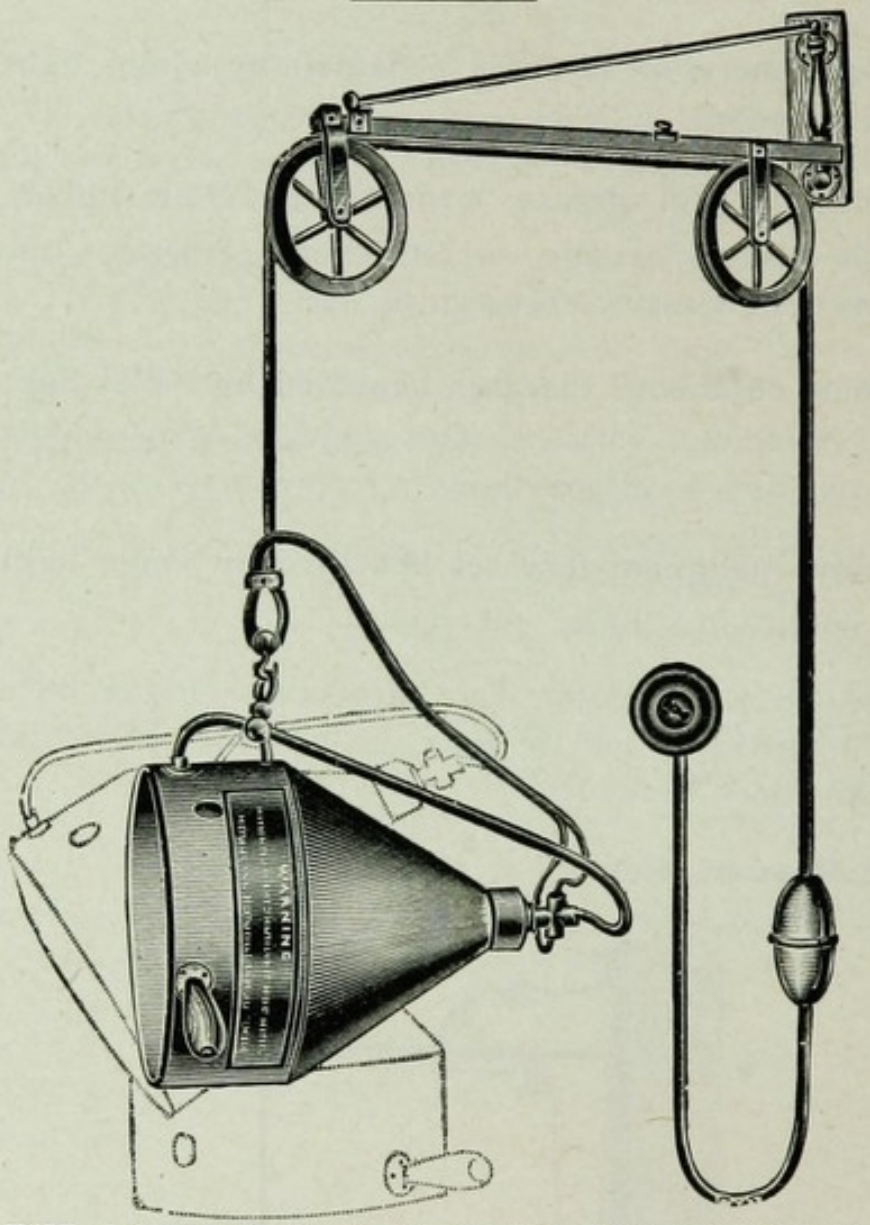
Cancer, epithelioma, lupus, tuberculosis, etc.

Minin, the Russian doctor who introduced the anæsthetic use of the rays, found it unwise to use the rays in hysterical patients as undesirable symptoms sometimes develop.

What is the Russian lamp?



The Russian lamp is a modified and improved Minin violet light apparatus, which consists of a cluster of seven violet incandescent lamps, with a total of 350 candle power, in front of a powerful reflector, so arranged as to be raised or lowered at will and any number of lamps from one to seven may be lighted, thus giving a varied intensity.



THE LONDON 500 C. P. THERAPEUTIC LAMP

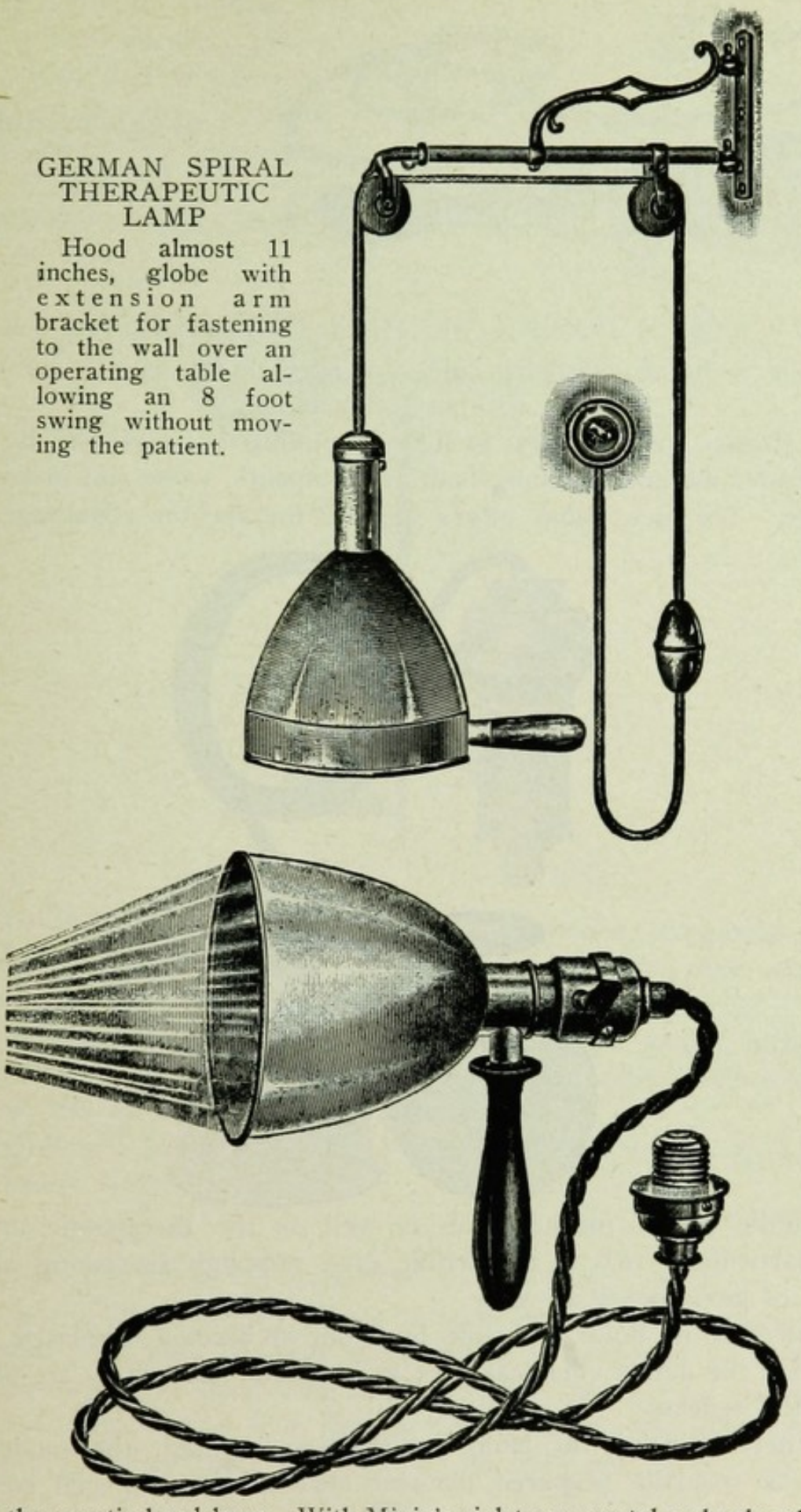
The London globe is over 7 inches in diameter, the hood 14 inches. Has tilting device for holding it at any angle or position for treating patients.



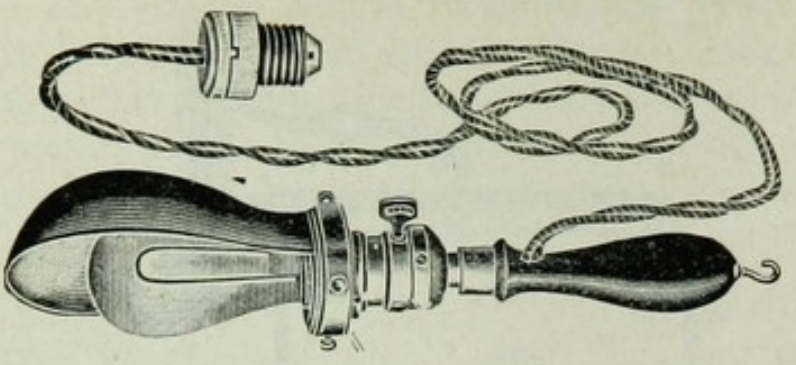
Dr. Minin's violet ray hand lamp with large violet ray bulb.

GERMAN SPIRAL THERAPEUTIC LAMP

Hood almost 11 inches, globe with extension arm bracket for fastening to the wall over an operating table allowing an 8 foot swing without moving the patient.



Giant therapeutic hand lamp. With Minin's violet ray crystal and ruby globes.



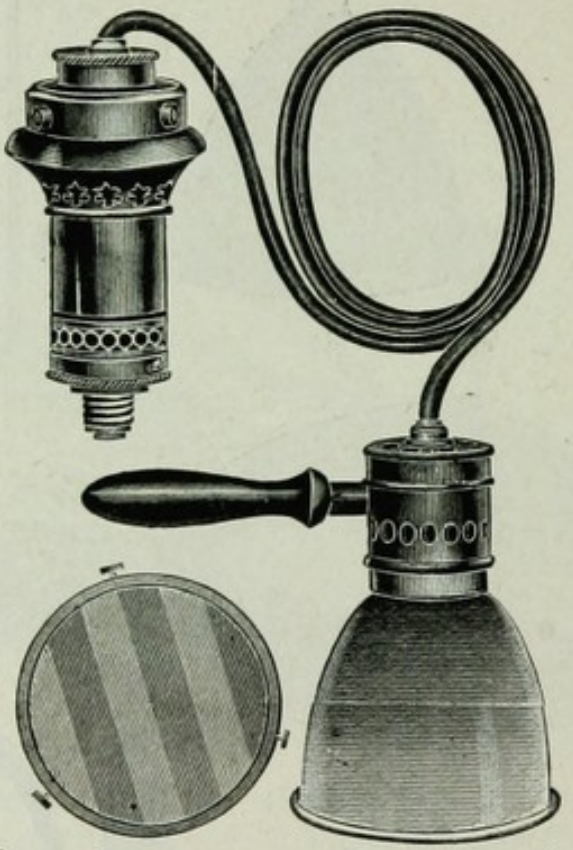
Operator's assistant hand lamp.

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200 CANDLE POWER WONDER THERAPEUTIC LAMP

No globe to break.—Greater light and heat energy at a lower cost than with any other lamp.

A distinct forward step in light-therapy is accomplished by this 200 c. p. wonder therapeutic lamp, both in therapeutic value and in economy to the user. The new lamp offers all the therapeutic advantages of the

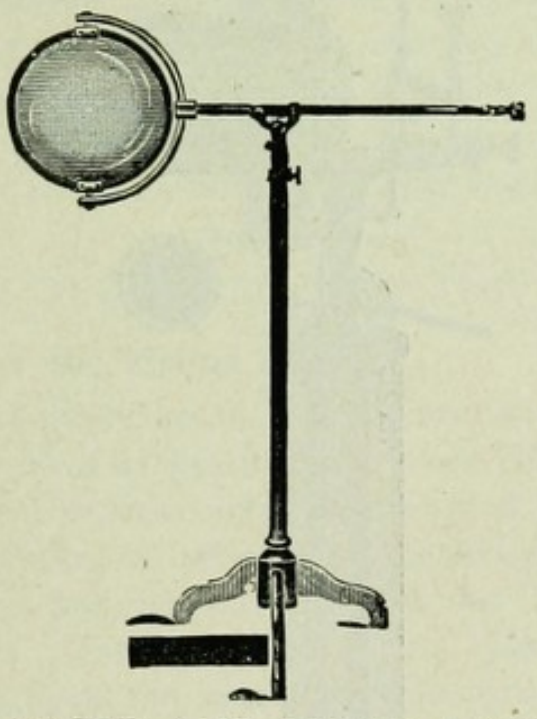


high candle power incandescent as well as the therapeutic arc lamps, being particularly rich in the actinic rays, although furnishing an intense amount of heat energy as well.

There are no bulbs to break, burn out or become misplaced, no glass globes for the active chemical rays to penetrate, no arc to regulate or to smoke the reflector.

A new principle in lamp construction is used, the mode passing through a specially prepared filament enclosed in a special composition

generating both the intense heat and light. Inasmuch as this special filament is held securely against a flat insulating surface without glass globe or bulb and without projecting, there is scarcely any chance of breakage and the lamp should last for years. The outfit includes a violet and ruby screen for securing particular therapeutic effects that may be desired. It requires 8-10 of an ampere and can be operated on either 110 or 220 volt direct or alternating service.



CANCER AND LUPUS LENS

At the Mehl institute (Oranienburg) near Berlin, thousands of cases of cancer and lupus have been cured during the past 25 years after they had been the rounds.

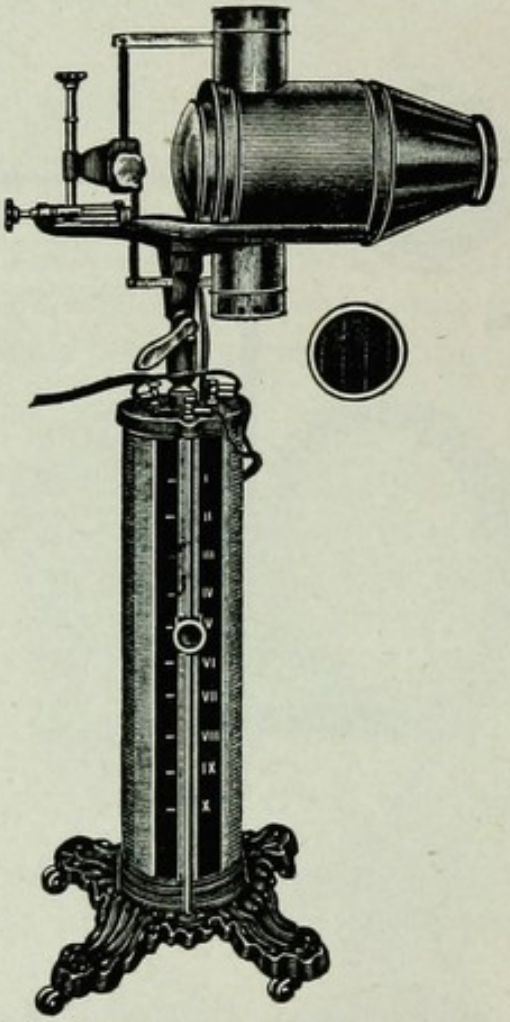
Consists of one 9 inch lens on telescoping stand, one 4 inch, one 1 inch, 2 red and blue hand glasses and also double cautery bulb with point for forcing cold air to the part cauterized.

American physicians who visit Berlin would do well to spend a day with Professor Mehl.

THE HELIOS THERAPEUTIC ARC LAMP

The new Helios arc lamp shown on page 248, has a powerful arc, generating heat, light and chemical rays, and is so arranged as to be used with either variety of rays, thus making it far superior to any form of incandescent lamp outfit. It is fitted with a ground glass reflector, which is so arranged as to change the focus of the rays and by another adjust-

ment the length of the arc may be varied, and by the heavy rheostat in the base, the strength of the mode may be regulated, thus giving a wide range of regulation and variation, and as the lamp is on an adjustable swivel it may be thrown in any desired direction. The light may be varied up to many thousand candle power, and the heat so regulated by the various controls, that an intense heat may be generated which will burn a hole in a board in a few minutes, but of course such an effect is not desired in



therapeutics. Any very mild treatment may be given as well. The naked arc is rich in the chemical or actinic or ultra-violet rays. The heat effect may be increased by means of a ruby glass screen, and the anodyne effect produced by a violet glass screen. This lamp has an almost universal range of application both mechanically and therapeutically.

This apparatus is handsomely finished and stands fifty-four inches high, mounted on casters and weighs, ready for shipment, about 110 pounds. It may be operated by a 110 or 220 volt lighting service, requiring from seven to twelve amperes from a No. 10 wire, and is intended for active work and is complete with rheostat controller, violet and ruby screens, and an assortment of carbons for producing various degrees of light and heat rays, to suit the various pathological conditions; connecting

cable and plug, ready to attach to an ordinary lamp socket. It should be made safe by means of fuse plugs and a double pole, single throw, knife switch.

The services of an electrician are not required after the proper wiring is done in your building as the lamp comes already set up and ready to attach to your lamp socket.

The helios lamp will operate from either direct or alternating mode. You should have, however, at least fifteen or twenty amperes of mode. Your lighting company can supply this by running a No. 10 lead wire into your building and providing proper fusing. The cost of operating the lamp is very low when the length of each treatment is taken into consideration, averaging about seven to twelve cents per hour.

THERAPEUTIC APPLICATION OF THE HELIOS LAMP

What are the uses of the Helios lamp?

The active rays of the helios therapeutic arc lamp are as nearly identical to the solar rays as it is possible to secure through artificial means. The history of medical practice has demonstrated the importance of the sun's rays in therapeutics as rational and effective, and the new lamp should be considered just as rational and, for practical purposes, as effective as solar light. The main value of the chemical or actinic rays is in the decomposing and at the same time reconstructive molecular action on the tissues. The oxidation produced stimulates and increases metabolism and thus increases nature's regenerative processes.

The blue, violet and ultra-violet rays, that is the shorter wave rays of the spectrum, are especially active in the destruction of bacteria which remain almost entirely indifferent to the rays of the other extreme of the spectrum; that is the red and yellow. The bactericidal powers of the helios arc lamp, which are strongly marked, are believed by the best scientists, to be due to the presence of "free" oxygen, and these powers are demonstrated especially in such inflammatory conditions of the skin as *acne* or *furunculosis,* where the therapeutic effect is especially prompt and certain.

We hold reports showing remarkable results after brief treatments with the helios lamp in extreme cases of *acne vulgaris* and *carbuncles,* as well as the gravest affections of the skin, the treatments in the cases being given with the blue glass screen interposed, lasting from ten to twenty minutes.

Psorasis, eczema, varicose ulcer, pityriasis and other chronic forms of skin diseases usually yield promptly to daily treatments of from three to ten minutes. *Baldness* and *indolent ulcers* are benefited by the treatment,

application in these cases requiring sufficient strength to produce a slight solar *erythema* or sun burn. This is also true in cases of *phagedenic ulcers.*

Under treatment from the helios lamp the dyspeptic's and the consumptive's anemic, dry and inactive skin soon gains a healthier aspect.

The helios lamp offers one of the most convenient and effective means for the relief of pain. The reports of Rosenburg confirm the fact that the blue, violet and ultra-violet rays can be regarded as a specific against pain such as *rheumatism, torticollis, pleurodynia* as well as *acute* or *chronic neuritis.* Pain of every description whether peripheral or visceral, when not due to inflammation, including *neuralgia, neuritis, spinal irritation, lumbago, sciatica, intercostal neuralgia, arthropathies and neurasthenia,* yield readily to treatments of from two to ten minutes duration once or twice a day. In severe cases the treatment is continued long enough to produce a decided *erythema.* This produces a counter irritation fully equal to that of the mustard plaster or fly blister, but lacks the unpleasant effects of these measures.

The same applies to *rheumatic gout, chronic arthritis, synovitis* and *tubercular diseases* of the joints, in which hot applications are indicated as the temperature secured will readily range from 80 degrees F. to 400 degrees F. In application to the spine and trunk in which stimulation is applied to the viscera, the parts should be rubbed with a towel saturated with cold water or with a piece of ice, after treatment.

Local gangrene, Raynaud's disease and similar conditions yield to the helios lamp assisted by cold applications and massage. The treatments last ten minutes and are to be of sufficient intensity to produce a solar erythema.

As a curative measure the helios lamp is of the greatest value in *gastritis, colitis, neuritis, chronic appendicitis, chronic gall bladder disease* and visceral affections, its peculiar penetrating powers being especially valuable.

The visible chemical rays of the lamp in these cases produce a specific photo-chemical inflammation of the skin causing a capillary dilatation which is detectable for even four or five months after treatment.

In *acute bronchitis* the treatment is peculiarly effective and is also indicated in *cardiac diseases, Bright's disease, chlorosis* and *malnutrition.*

The helios lamp can also be used in connection with electric light baths, vapor baths or hot air cabinets, as a projector producing general perspiration along the lines indicated in thermo-therapy as well as for its photo-therapeutic effects.

ELECTRO-DIAGNOSIS

Of what value is electro-diagnosis?

Electrification is not only very useful in the treatment of diseases, but it is also useful in the diagnosis and prognosis as well, and may be employed as an aid to both in a number of ways.

By means of electro-diagnosis we are able to distinguish between real and apparent death, to decide between genuine and feigned disease, as practiced by malingerers, to differentiate central from peripheral paralysis, and to detect the presence of foreign metallic bodies, such as bullets, and fragments or iron, etc., in the tissues.

What is the electro-diagnosis of death?

None of the usual tests of death are as reliable and decisive as faradization, which indicates death with absolute certainty, within several hours after it occurs. The time at which the muscles will not respond to the electric stimulus varies somewhat with condition at the time of death, and nature of the disease, but it is a general rule that the shorter the disease, and the death, the sooner the electric excitability of the muscles disappears, so that if within from three to five hours there is no contractions of muscles following faradization, then you may know with absolute certainty that the subject is dead.

Crimotel, of Paris, after much experimentation in cases of apparent and real death from many causes, has formulated the following conclusions:

1. Death is certain when all the muscles have entirely lost their faradic contractility. No disease, poisoning or asphyxia, will, during life, abolish electric contractility in *all the muscles of the body.*

2. Faradization is an indispensable test whether life is extinct in all cases of apparent death occurring suddenly. When there are several vic-

tims, as after accidents, it enables the attendants to distinguish the dead from the living, and also the order in which the dead ceased to live.

3. In new born infants, muscular contractility, under the influence of the faradic mode, continues fifty to sixty minutes after the heart has ceased to beat. When they have never exhibited signs of life, the faradic test shows whether life is really extinct.

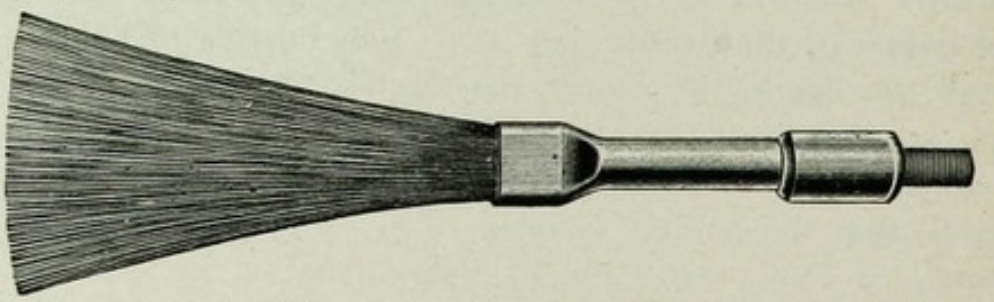
4. In some cases of cholera, electro-muscular contractions cease within half an hour after death.

What is the electro-diagnosis of foreign bodies?

The detection and location of foreign metals in the tissues is entirely mechanical, and is accomplished by means of a flexible probe, made of two spiral wires, insulated from each other, or by a combination of a canula, and trocar, insulated from each other. Both are connected with a weak cell and a meter in a series, and when the probe comes in contact with the metal, there is a circuit formed, which is shown by the meter needle. Some of these probes are attached to a microphone, so that the sound of the impact and the vibration caused by the closing of the circuit may be heard by the operator. However, these things may be so much more easily detected by the X-ray and fluoroscope, and the probes are so fragile and liable to get out of order, that they are seldom used for diagnosis.

What is the electro-diagnosis of malingering?

For the detection of feigned disease in persons who want either sympathy or damages, the deception may be shown by means of faradization with the wire brush, shown below, the application of which is very painful and harmless, except in cerebral troubles.



In these cases if there is electric muscular contractility after two weeks, you may be sure there is a fraud proposed, but in obscure cases the tests should be made carefully as in diagnosing obscure paralysis.

ELECTRO-DIAGNOSIS IN PARALYSIS

What are the methods of electro-diagnosis of paralysis?

Electrification in the diagnosis and prognosis of paralysis is the most

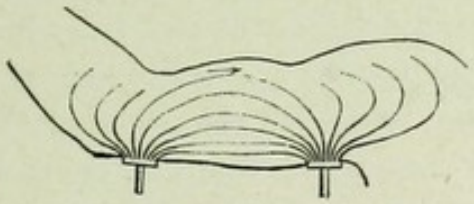
important part of this subject, as on the careful examination will depend, often not only your reputation, but possibly the life, comfort and happiness of your patient.

Both the faradic and galvanic modes are used in diagnosis, and either may be applied in three ways, viz: the direct, indirect and polar.

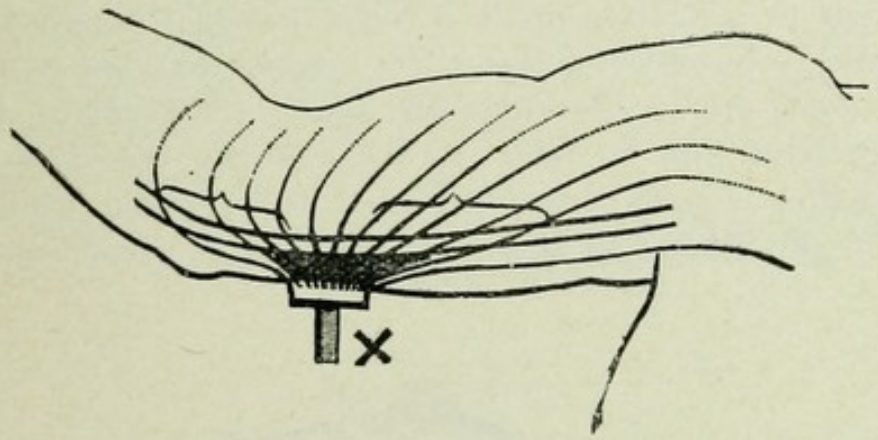
INDIRECT. Place one electrode over the ganglia or nerve trunk, with the other at a distance.

DIRECT. Place the electrode either over the motor point or on the muscle, with the other at a distance.

Both applications may be made with either one or both poles.



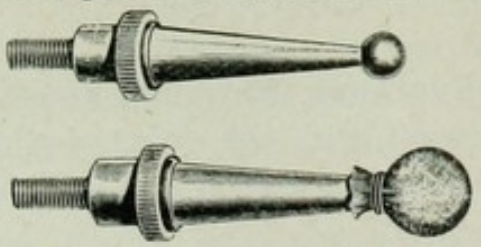
BIPOLAR. Place both electrodes close together, so as to include between them part to be tested.



UNIPOLAR. Place one electrode over the ganglia, nerve or muscle, and the other at a distance.

A number of suitable electrodes are needed either self-retaining or otherwise. The patient must be in an easy position with the muscles to be examined in a relaxed state and bare. The skin must be well wet, as well as the electrodes, which are to be applied to the nerve trunks or centers, the motor points, or to the muscles. Hold firmly in position, and begin with weak modes, gradually increasing as you proceed. A meter while not essential is advisable for precision. An automatic interrupter is also advisable.

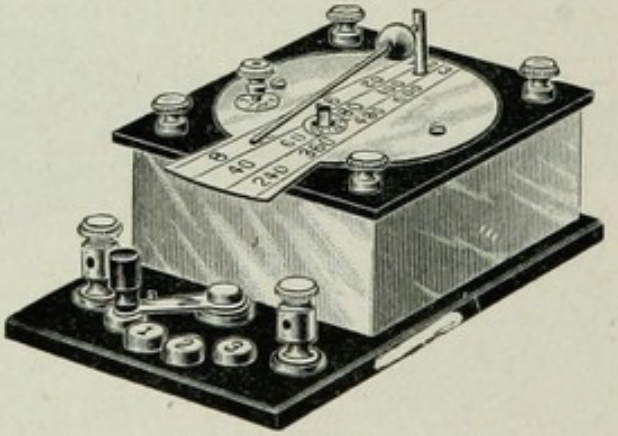
For testing the motor points the Erb electrodes, shown herewith, are used. These are small ball point rods, covered with cotton or wet leather



mounted on wooden or hard rubber handles and held in the hand of the operator.

In making electrical tests upon the arms or neck with the galvanic mode, place the indifferent electrode, which should be of large size, upon the sternum, while the other electrode, which should be small, is placed over the spot to be tested. If the spine is to be tested, place the large sponge at the sacrum, and with the other electrode go over the whole region as required. An automatic interrupter is preferable to an interrupting electrode operated by the hand of the operator. It will be readily understood that with a hand interrupter nice distinctions cannot be made, and sometimes very careful tests are required to decide as to conditions.

FARADISM. Rapidly interrupted faradization is the most powerful electric stimulant to a healthy nerve. When passed through a muscle it will cause a quick contraction, followed by a relaxation, but as the periods of the faradic mode are so close together, there is no interval, so that the muscles do not have time to relax between shocks, therefore there is a constant contraction or state of tetanus, which will continue while the mode is passing. For this reason an automatic rheotome is needed and is shown herewith.



In testing the condition of either the paralyzed muscle or nerves with the faradic mode, observe the following:

1. Whether a muscular contraction is produced or not.

2. If one is produced, what is the minimum strength of mode required to produce it, and whether the character of the contraction is in any way altered; that is, the strength of mode and the rapidity, whether slow or quick, of the interruptions required to produce the minimum amount of contraction.

GALVANISM. When an interrupted galvanic mode is passed through a muscle, there will be contractions caused when the circuit is made and broken, and we have found that the contractions differ with the make and break. The healthy muscles will contract more strongly with the break than the make, and with the negative more than the positive, which are important points to know, and which will be elaborated later (p. 356), but the galvanic mode does not produce as strong contractions as the faradic.

On the other hand the diseased nerves and muscles will not respond as readily to faradization as they will to galvanization.

With the galvanic mode, note:

1. Whether a contraction is produced or not.

2. If one is produced, note (*a*) the order of the polar reactions; (*b*) what is the minimum strength required to produce a contraction; (*c*) the character of the contractions, whether healthy or not; (*d*) the strength of mode required to produce tetanus; (*e*) whether the contractions are more easily excited by slow or quick interruptions of the mode.

The contractions in any muscle depends on the nerve supply to it. If there is good enervation, the muscles will respond most quickly to rapid interruptions, but if the nerve supply is poor, the interruptions must be slow to cause the contractions, and the wide range of irritability between the extremes is the field for electro-diagnosis.

PROGNOSIS IN PERIPHERAL PARALYSIS

What is the prognosis in paralysis?

Provided the cause can be removed, as a rule, if there be but little wasting of the muscles and they respond somewhat to faradization, a cure may be expected in a comparatively short time. If the muscles are much wasted, the disease has lasted a long time, and the muscles refuse to respond to the application of either kind of mode, the case, though possibly curable, requires a guarded prognosis. In case of complete wasting of muscles following paralysis, it is useless to expect improvement.

NORMAL REACTION. FORMULA

What is the normal muscle reaction formula?

As before stated, when we apply a galvanic mode to a nerve, and interrupt the same, a contraction takes place in the muscle, differing in intensity with the pole used, the strength of the mode, and the condition of the parts. In health, these contractions take place in the following order:

1. When the negative pole is suddenly applied, a contraction takes place, termed Cathodal Closing Contraction, the symbols being Ca. Cl. C.

2. When the positive pole is suddenly applied, and a contraction takes place, it is called Anodal Closing Contraction, written thus: An. Cl. C.

3. When the positive pole is suddenly withdrawn, the contraction is called the Anodal Opening Contraction, written: An. O. C.

There is a fourth, called the Cathodal Opening Contraction, but it is too painful to produce, and I seldom attempt it. As a rule, it requires only one-fourth the mode strength to produce the first, or Ca. Cl. C., as for the last, or Ca. O. C. For practical purposes, therefore, we will drop the latter formula. We may also drop the final letter in all of the formulas for the sake of convenience.

The average mode strength required to produce normal contractions we may tabulate as follows:

1. C. C. (Cathodal closing).....2 to 5 milliamperes
2. A. C. or A. O. (Anodal closing or anodal opening).6 to 8 milliamperes

It will be well to observe that in making such experiments, that after the skin has become well wetted, less mode will be required to produce a contraction than when it is dry, and this must be taken into account in diagnosis.

Such tests should be applied whenever possible, so as to become familiar with all the reactions.

The contraction of a muscle, in health, is very quick and short, unless the dose is too strong. This applies, of course, to the galvanic mode.

REACTION OF DEGENERATION

What is the reaction of degeneration?

Immediately after a muscle has been injured severely enough to destroy a portion of a motor, or mixed nerve, it has been found by Erb that atrophy of the muscular fibres sets in, which may be seen during the second week, and reaches its limit about the fifth or sixth week. At first it ceases to respond to faradization; then follows a period when it will act only to a slowly interrupted galvanic mode, and finally ceases to react

to any form of electrical stimulation; he termed this the *reaction of degeneration.* It is present in paralysis arising from rheumatism, lead palsy, the paralysis peculiar to writers, telegraph operators, etc. In those difficult cases after railway and other accidents, when persons demand compensation for damages, the existence of the reaction of degeneration would be a fact of vital importance in favor of the applicant, as it would indicate that he was suffering from a serious injury of the nerve. Such a demonstration in a court of justice is more conclusive than any amount of authoritative opinion.

MOTOR POINTS

What is the value of knowing the motor points?

When a nerve center is stimulated by electrification, it will cause a contraction in the muscle or group of muscles, supplied by that nerve. The stimulus may be applied to any part of the trunk of the nerve, either before or after it reaches the muscles, but the most decided response follows the stimulation of the nerve, right at the point where the nerve enters the muscle, and many experimenters have located these points, and they are definitely known, and may be found by all. They will, of course, vary a little in different persons, but it is comparatively easy to find them within a short distance of the usual place, as is shown in all the accompanying cuts, shown on pages 358 and 360, made from photographs of the living model.

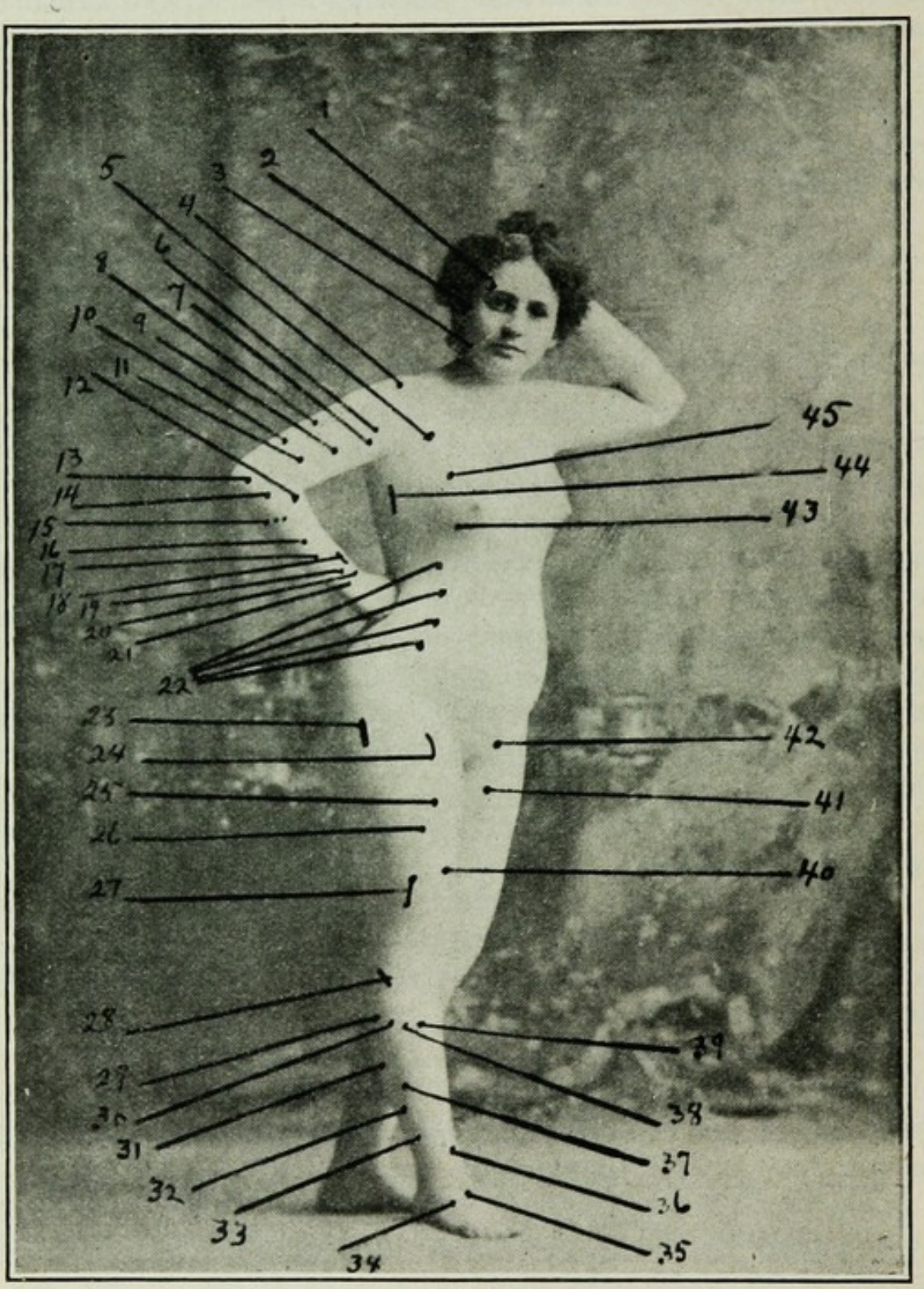
The motor points decrease in irritability as we get further away from the main nerve centers.

The motor points are also influenced by the physique of the person, and are not as marked in the large or fat, as in the small and lean. The muscular development also makes a difference, the larger and coarser the tissues the more mode is required.

The state of health of the subject also makes a difference in the conductivity, and therefore in the muscular excitability. A strong full blooded person will be a better subject than a weak, anæmic, debilitated person.

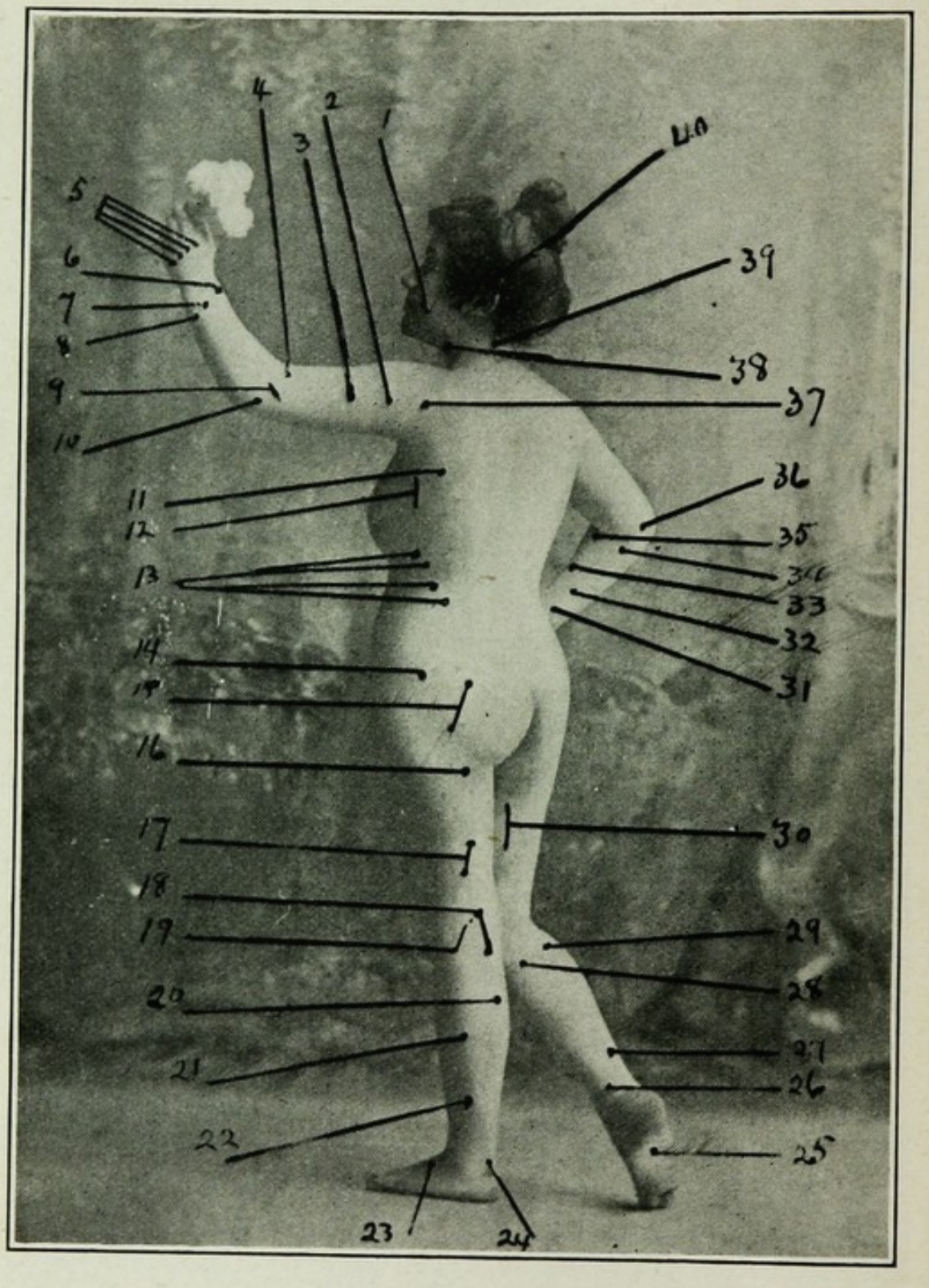
It has been shown that the different nerves will vary in their normal electric excitability, and the following list of ten prominent nerves shows their relative order of excitability:

1. Spinal accessory; 2, Branch to levator angulæ scapulae: 3, Ulnar; 4, Median; 5, Facial; 6, Cervical plexus; 7, Anterior crural; 8, External popliteal; 9, Musculo-spiral; 10, Internal popliteal.


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ANTERIOR
SUPERFICIAL NERVES AND MUSCLE MOTOR POINTS

1 Supra orbital nerve.
Corrugator supercilii muscle.
2 Facial nerve, (upper branch).
3 Facial nerve, (lower branch).
4 Deltoid muscle, (middle).
5 Deltoid muscle, (anterior).
6 Musculo-cutaneous nerve.
7 Biceps muscle.
8 Musculo-spiral nerve.
9 Brachialis internus.
10 Triceps muscle.
11 Median nerve.
12 Supinator longus.
13 Exten. carpi ulnaris.
14 Supinator brevis.
15 Exten. digit. communis.
16 Exten. digit. minimi.
17 Extensor indicis. (a).
18 Extensor indicis. (b).
19 Exten. oss. metacar. poll.
20 Exten. prim. inter. poll.
21 Exten. sec. inter. poll.
22 Rectus abdominis.
23 Tensor vaginæ femoris.
24 Crural nerve.
25 Quadriceps. (common point).
26 Rectus femoris muscle.
27 Vastus externus muscle.
28 Peroneal nerve.
29 Gastrocnemius muscle.
30 Peroneus longus.
31 Soleus muscle.
32 Peroneus brevis.
33 Flex. hallucis longus.
34 Interossei dorsales.
35 Exten. digit. commun. brevis.
36 Exten. hallucis longus.
37 Soleus muscle.
38 Extensor digit. longus.
39 Tibialis anticus nerve.
40 Cruralis muscle.
41 Sartorius muscle.
42 Crural nerve.
43 Pectoralis minor muscle.
44 Thoracicus longus nerve.
Serrat. antic. mag. muscle.
45 Pectoralis major muscle.


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POSTERIOR
SUPERFICIAL NERVES AND MUSCLE MOTOR POINTS

1 Facial nerve. (middle branch).
2 Triceps muscle.
3 Musculo-spiral nerve.
4 Brachialis internus.
5 Interossei dorsales.
6 Exten. prim. intern. poll.
7 Extensor indicis.
8 Extensor minimi digit.
9 Extensor radii brevis.
10 Ulnar nerve.
11 Latissimus dorsi.
12 Thoracicus longus nerve.
Serrat. anticus magnus muscle.
13 Obliquus abdominis ext.
14 Tensor vaginæ femoris.
15 Gluteus maximus.
16 Great sciatic nerve.
17 Biceps femoris. (long cap).
18 Posterior tibial nerve.
19 Peroneal nerve.
20 Gastrocnemius muscle.
21 Soleus muscle.
22 Flexor hallucis longus.
23 Extensor digit. commun. brev.
24 Posterior tibial nerve, (low).
25 Plantaris muscle.
26 Flexor digit. communis.
27 Tibial nerve.
28 Gastrocnemius, (int. cap).
29 Gastrocnemius, (ext. cap.
30 Ischiaticus nerve.
31 Median nerve.
32 Flexor longus pollicis.
33 Flexor digit. sublimis.
34 Flex. digit. commun. prof.
35 Flexor carpi radialis.
36 Ulnar nerve.
37 Deltoid, (posterior).
38 Hypoglossal nerve.
39 Spinal accessory nerve.
Levator anguli scapulæ muscle.
40 Facial nerve, (middle branch).

How should we select the modalities for the various desired effects?

In choosing any special kind of an electric mode for the treatment of any given condition, the structure to be treated must suggest the mode to be used. If the structure or tissue is coarse (muscle, etc.) we would resort to the faradic mode which contracts and relaxes muscle fibers. If we wish to make an impression on the local nutrition of these parts, the galvanic mode would be the one to use. If we wish to alter (augment or diminish the blood supply) we would use a static mode. If it is our desire to act upon the vaso-motor nerves, or, in fact, on nerve cells and nerve fibers generally we would resort to some form of high frequency. The high-frequency coil (uni- or bi-polar) is adapted to trophic perversions of the nerves. For the skin (circulation and nerve supply) we would use the resonator. As a metabolic alterant, locally and constitutionally, the diasolenic high frequency zone, or the magnetone or wave generator, is unsurpassed. The general rule is: The coarser the structure, the coarser the mode to be used; the finer the structure, the finer the mode. For electrolysis and phoresis use the galvanic mode. The polarity depends upon the effect to be produced. The negative pole relaxes, the positive pole contracts. These rules are the foundation of all scientific electro-therapy.

To sum up, all known effects of an electric mode upon and near its conductor are:

(a) Heat,
(b) Magnetization and induction,
(c) Electrolysis, including phoresis.
    1. Cathode (hyperæmia),
    2. Anode (ischæmia).
(d) Stimulation,
    1. Muscular (coarse alternation),
    2. Nervous (fine alternations),
    3. Metabolic (sinusoidal and high-frequency, X-radiation and magnetization).
(e) Psychic or central nervous effects, due to
    1. Sensations,
    2. Suggestions.

With these physio-chemical effects fixed in mind, and with some familiarity with the necessary apparatus, electro-therapeutics is a simple and very valuable addition to the physician's armamentarium.

Heat is of so little use practically as a result of electrification that it needs no further mention here. A burn by a heavy mode is simply a burn, and is treated as such.

The question as to the application of electrification in any given case is very simple.

(a) Does any part of the body require increased blood supply? (Cathode.)

(b) Does any part need reduction of its blood supply? (Anode.)

(c) Do any muscles require stimulation? (Coarse faradic or interrupted galvanic.)

(d) Do any nerves need stimulation? (Fine or rapid faradic.)

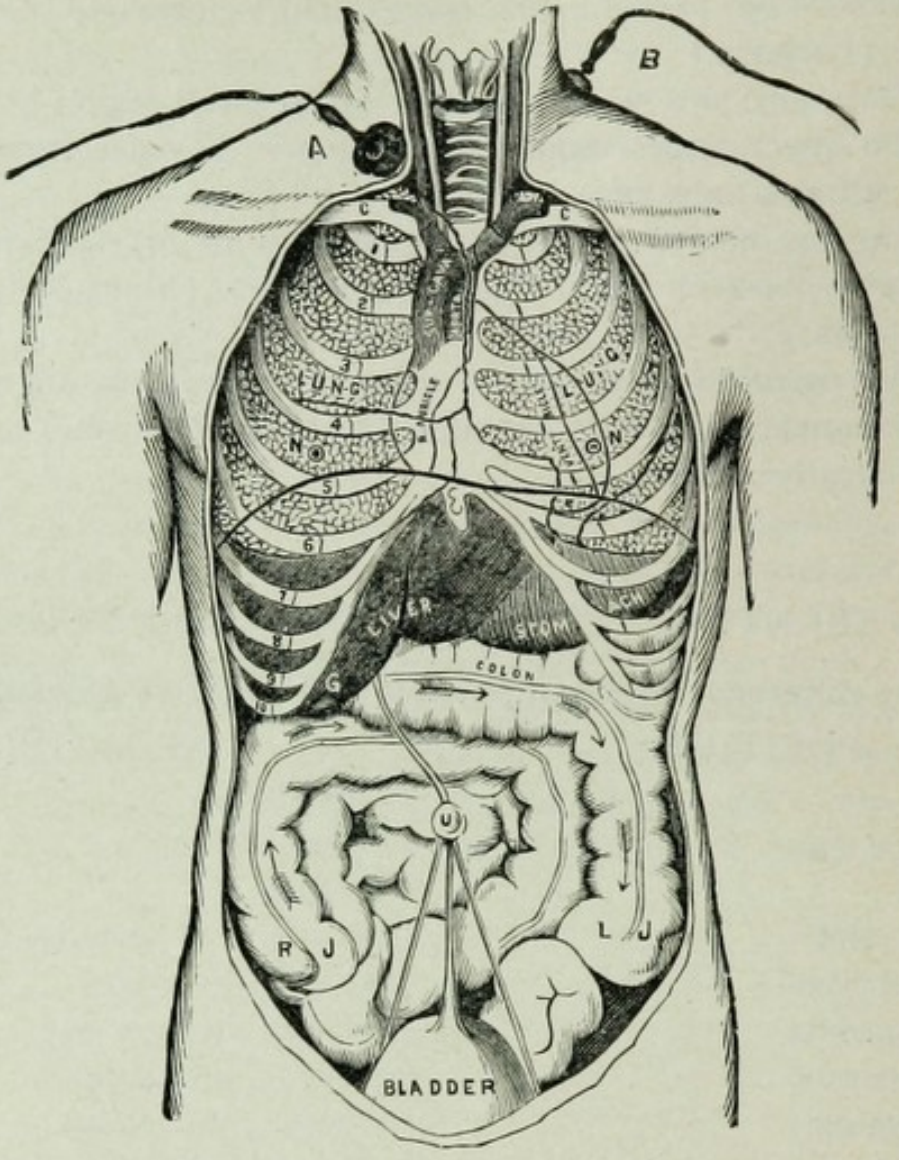
(e) Is metabolism of any part defective? (Sinusoidal, magnetization.)

(f) Are none of these things wanted? Don't use electrification. Treatment of warts, tumors, hairs and blemishes, etc., is more nearly surgical.

DIFFERENTIAL POINTS IN GALVANIC POLARITY

What is the difference between positive and negative galvanism?

POSITIVE	NEGATIVE
Is acid	Is alkaline
Hardens	Softens
Denutritive	Nutritive
Promotes a clot	Dissolves and absorbs a clot
Liberates oxygen	Liberates hydrogen
Produces anæmia	Produces hyperæmia
Slows circulation	Quickens circulation
Allays excitability	Increases excitability
Decreases local heat	Increases local heat
Retards hemorrhage	Increases hemorrhage
Repels soluble salts	Attracts soluble salts,
Lessens inflammation	Aggravates inflammation
Decreases vascularity	Increases vascularity
Has a drying influence	Has a moistening influence
Lessens nerve irritability	Increases nerve irritability
Is a vaso-motor contractor	Is vaso-motor dilator
Used in acute conditions	Used in chronic conditions
Is coagulating to albumen	Is liquefying to albumen
Intensifies scars and strictures in canals	Dissolves scars and strictures in canals
Decomposes all metals (except gold, platinum and aluminum)	Does not decompose any meals (except aluminum)



(Cut after Gray. Explanation from Haynes.)

This illustration shows the principal landmarks for locating the internal organs with sufficient accuracy for the purposes of electro-therapeutics.

C. C. marks the clavicle.

The ribs are numbered to correspond with the numbers at their spinal termini. It is useful to remember that the sternal end of each rib lies on a lower level than its vertebra. A line drawn horizontally backward from the middle of the third costal cartilage at its junction with the sternum would touch the body, not of the third dorsal but of the sixth dorsal. This varies a little according to the length of the sternum.

The eleventh and twelfth ribs can be felt even in corpulent persons, sloping downward. The head of the last rib is on a level with the spine of the dorsal vertebra.

The nipples (of male) usually lie between the fourth and fifth ribs, about three-fourths of an inch external to their cartilage.

The *right lung,* directly in front, is shown terminating on a level with the sixth rib, and the *left lung,* between the sixth and seventh ribs.

The *heart* is marked by a dark outline. The usual place to locate the electrodes for reaching it is over the sternum (breast bone) just above E, while the other is placed over the cervical ganglia, or at the *right* side of the neck at the point where the electrode A is placed in the cut. An electrode at the same spot on the *left* side of the neck modifies the respiratory movements.

The *lobes* of the *lungs* are outlined by the wavy dark line just above the fourth rib on the right, and between the fifth and sixth on the left.

The diaphragm is marked by the irregular dark line extending across the cut. This shows its attachment in front to the ribs and sternum.

E marks the cartilage ending the sternum (ensiform cartilage).

The stomach may be electrized by placing a large, broad electrode between the false ribs below E and two fingers' breadth above U.

The liver may be reached by pressing one electrode inward and upward just below the tenth rib. When the stomach is empty the liver may also be reached by pressing the electrode located below the sternum a little inward to the right, and upward.

G indicates the location of the gall bladder.

The colon, when treated for torpidity, should have the negative electrode carried over it from R J to L J, in the direction indicated by the arrows.

U is the umbilicus. It is located as a rule above the level of the body of the third lumbar vertebra.

The spleen. Place a broad electrode over the tenth and eleventh ribs on the left.

The bladder may be reached by placing one electrode above the pubic bone and the other over the lumbo-sacral region.

Electrode A marks the point at which the mode may be made to stimulate the pneumogastrics and cervical sympathetics.

Electrode B marks the location from which a mode may be made to reach the brachial plexus of the corresponding side.

How is electrification used as an anæsthetic?

Sinusoidal alternating electric modes of sufficiently high frequency, and in which the positive and negative phases were nearly equal, possess the power of producing local anæsthesia. After the frequency has reached

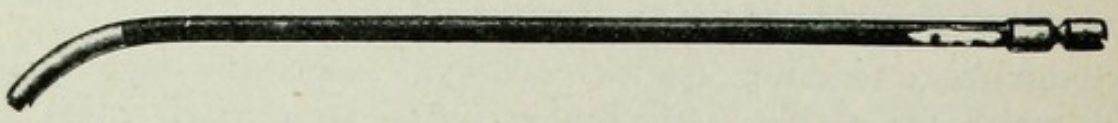
5,000 complete alternations per second the muscular contractions so familiar with medical batteries and other alternating modes, decreases, and at 25,000 alternations per second a mode passing from the elbow to the hand completely deadens that portion of the arm, and needles may be passed through the flesh without being felt. When subjected to modes of such high frequency, the sensory nerves appear to lose power of transmitting sensations.

The tetanizing effect of the high tension secondary induced mode has been used in dentistry, for the purpose of obtunding pain incident to the extraction of teeth.

The apparatus used for this purpose consists of an induction coil, wound with a very fine wire and provided with an interrupter which gives 25M vibrations per second, and constitutes the most important part of the apparatus. The patient places himself in an ordinary dental chair, takes the negative electrode in his left hand, and the positive in his right. The mode is gradually increased to the limit which the patient is able to endure. Then the forceps, which are connected with the positive electrode, are placed upon the tooth, and it is immediately extracted and the mode interrupted. The patient experiences no other sensation than the prickling produced in the hands and forearm by the passage of the mode. The secret of the anæsthetic effect produced by the electrical mode obtained from this apparatus, seems to reside in the extreme rapidity of the interruption.



Uterine stenosis set of three tapering tips and universal staff.



Intra-uterine electrode with copper or aluminum tip. (3 mm. in diameter).

PAIN

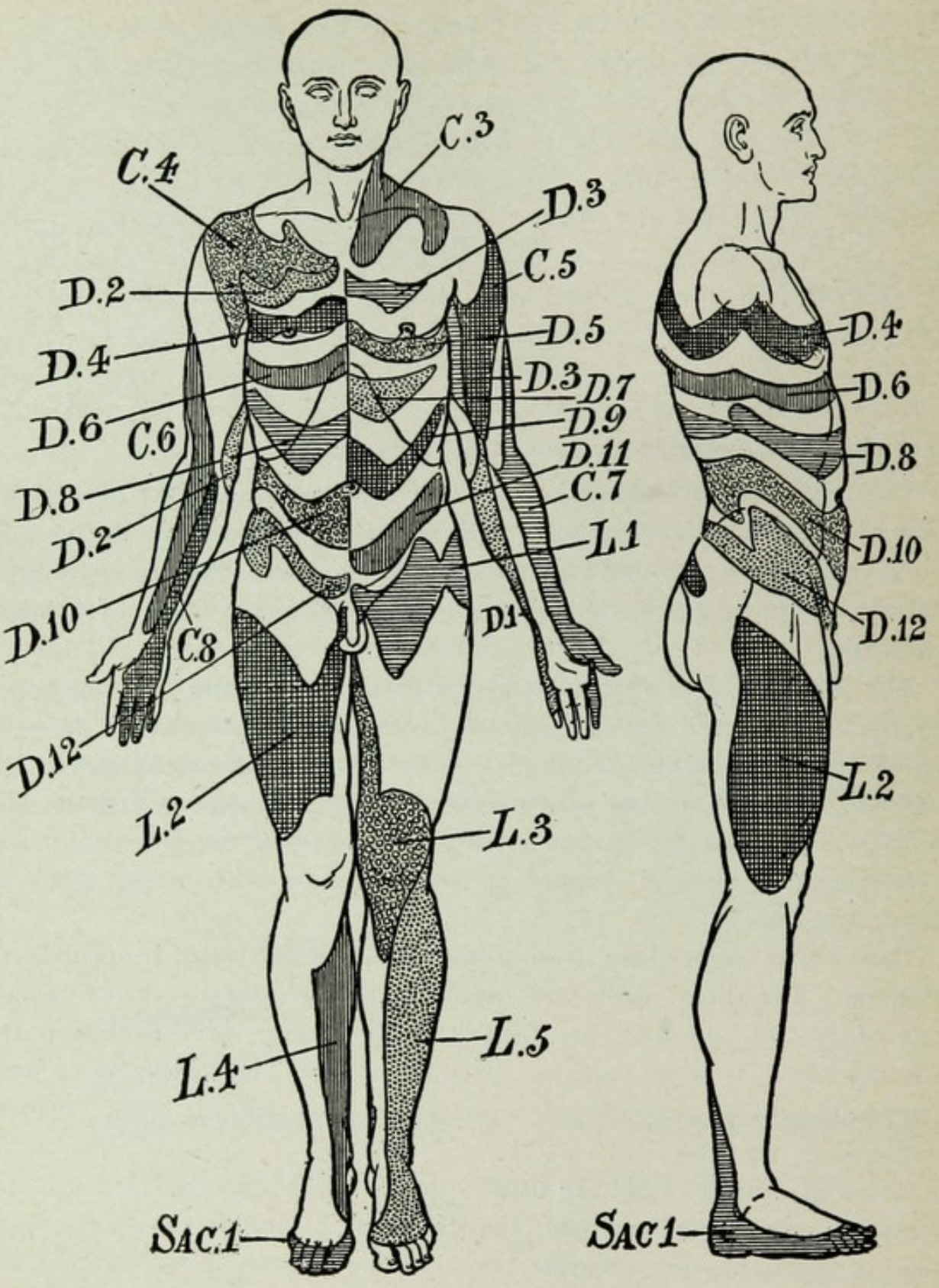
What effect has electrification on pain, and anæsthesia?

The relief of pain is one of the great functions of all forms of electrification when administered properly with the positive pole as the active one. Pain is only a symptom, but is the most constant, annoying and significant symptom in aiding us in our diagnosis, treatment and cures by electrotherapeutics.

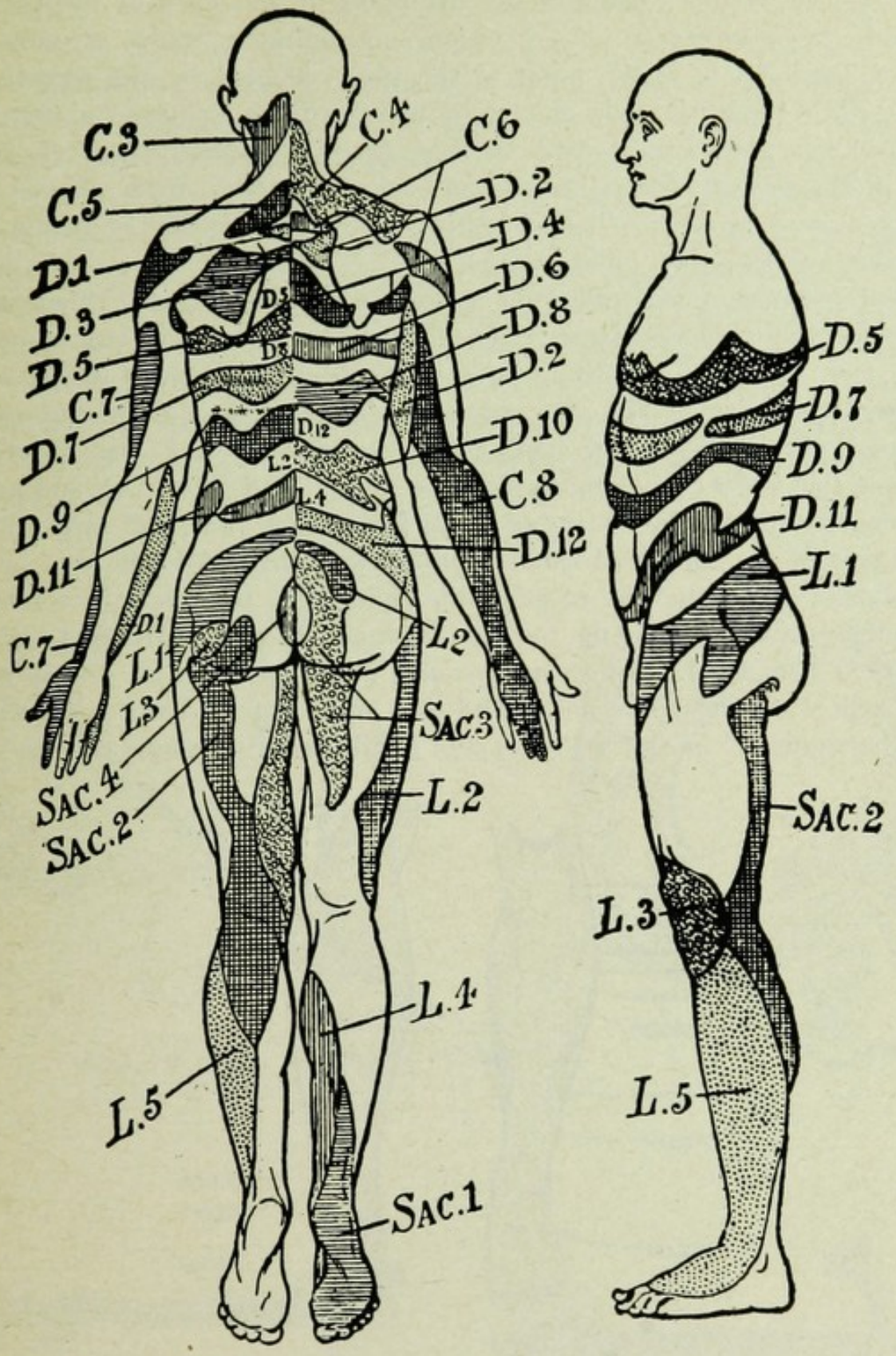
The presence of this symptom is the danger signal and warning to get busy for its relief and for the removal of its cause. The absence of pain, when diseased conditions are known to exist, is also most significant in the prognosis. If there was no pain we should have few patients to treat, and too often as soon as the hurt is stopped the patient thinks he is well, and the treatment is likewise stopped, as well as some other things, such as practice and income.

Pain starts somewhere from some cause, which may be central or peripheral. Peripheral pains are usually local and due to visible causes. Pains of central causation are usually more general, or diffuse and the cause not seen. Indirect pains are harder to locate, and will be more carefully studied under the title of headaches, which are the most frequent indirect pains we are called on to treat electrically.

Pains of central origin are usually due to some spine lesion, and careful experiments by eminent neurologists, such as Head and Gowers, have given us approximately accurate maps of the human body, locating the areas, zones, or lines of pain or absence of pain, which indicate the location of the central spinal lesion. These maps are shown in the accompanying cuts of the full length figures of the man, showing front, back and both side views. While these are not claimed to be absolutely accurate,



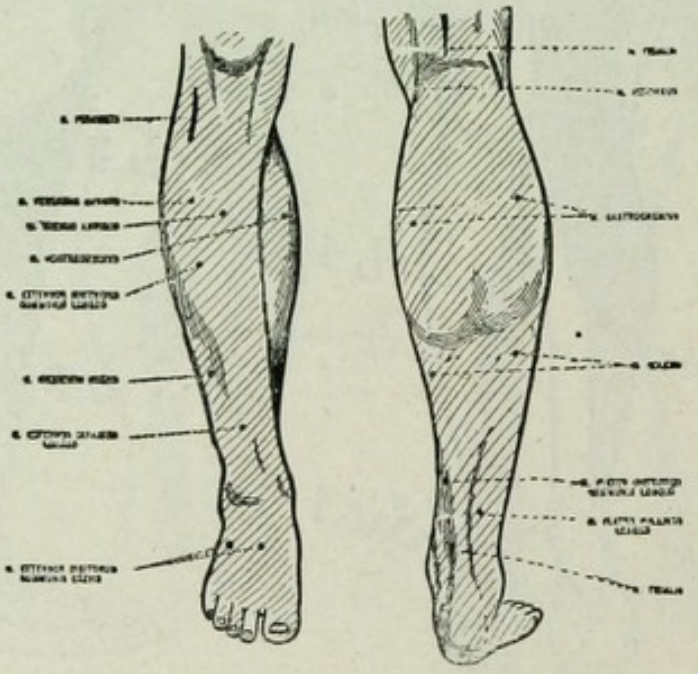
they are approximately so, and are a reasonably reliable guide for us to follow, and a valuable means of diagnosis and assistance in our electro-therapeutic treatment.



The different shaded areas, zones or belts, shown in the accompanying figures (after Gowers) indicate both the peripheral location of the anæsthesia, or hyperæsthesia of the skin, and also the location of that part of the spine which is most probably affected, and indicating the point at which

we should apply our treatment for the relief of and cure of the pain, or paralysis, be it either motor or sensory. Usually the cause of motor or sensory paralysis is at the point in the spine denoted by the figures and letters, while the girdle pain or area of hyperæsthesia is due to irritation of the spine just above the lesion. In these figures the letters C, D, L and S refer to the cervical, dorsal, lumbar, and sacral vertebra, from whence issue the corresponding pairs of spinal nerves, which are distributed to the various shaded areas on the human maps.

For instance, I was called on to treat a case of alleged "rheumatism" of the feet, which was characterized by partial paralysis, or loss of motion in the feet, with most persistent pain in the heel and regions of the tendo achillis, in both legs. The case not responding to any or all of the usually indicated electro-therapeutic and magnetic treatment, I was forced to conclude that there was nothing local the matter, and after long and persistent inquiry, elicited the history of a fall from a low roof, and injury to the lower part of the back, and when attention was directed to the first lumbar articulation, we located the cause of the pain. You will see by referring to the human skin maps that the toes and back and bottom of the foot and heel is marked Sac. 1. I gave an unfavorable prognosis, and he drifted away, but I kept watch over him and found that, after going to various baths for his "rheumatism," he got no relief and finally, after a couple of years, the



pain stopped through degeneration of the nerve, so that it had sensory paralysis, and today he has no pain, but has the halting gait, due to partial motor paralysis. Another similar case came for the treatment of a severe pain in the area shown as marked with the L5, the most pain being on the

right instep. He also had slid from a roof on to a pile of lumber, very appropriately injuring the lumbar spine. After a month's careful scientific electro-therapeutic treatment, with not even relief, I diagnosed acute neuritis, and prognosed ultimate complete degeneration, sudden relief from pain, and then complete motor paralysis in the dorsal foot flexors, presided over by the anterior tibial nerve. He went to an ignorant quack who "guaranteed a cure in a week, or no pay," who collected his pay in advance, and then held the case for two months without any relief whatever, before he was fired. In the course of five or six months the pain stopped, and now he walks with a cane and drags his toes. A careful study of the human skin maps and examination of the cases along these lines will prove very beneficial in the diagnosis, prognosis and treatment of many obscure spinal lesions characterized by girdle pains, hyperæsthesia, anæsthesia and motor paralysis.

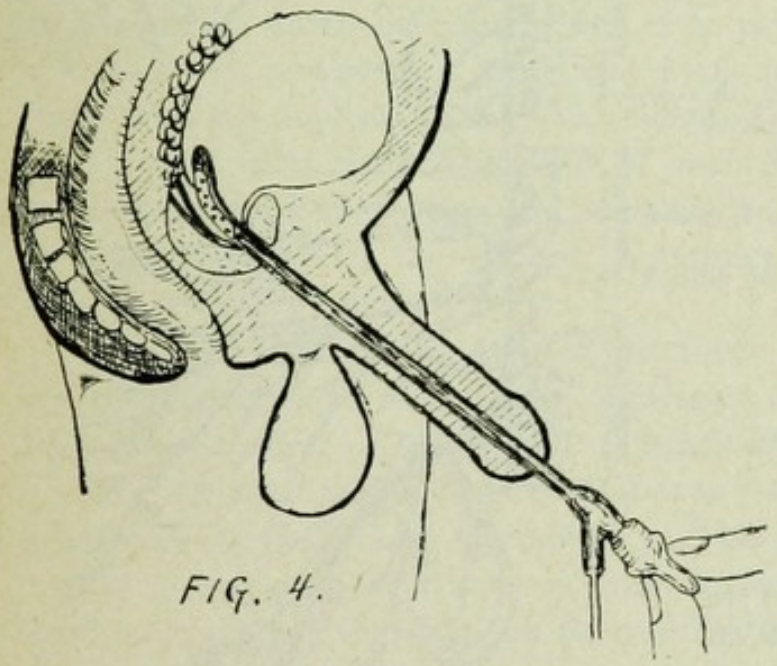


FIG. 4.

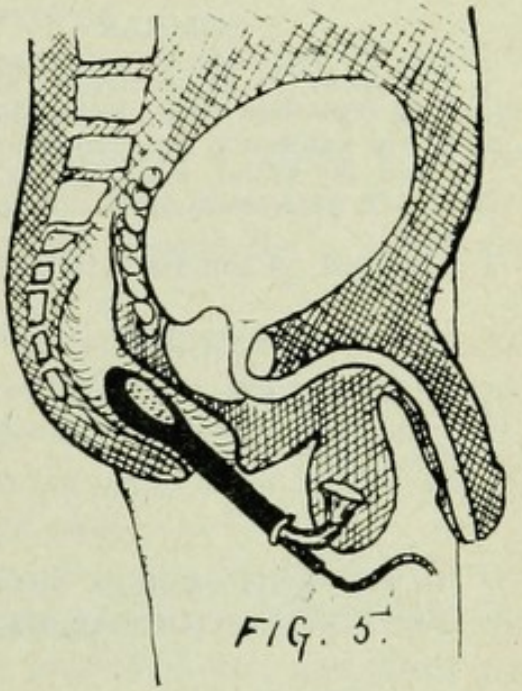
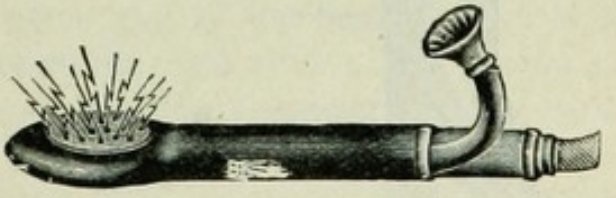


FIG. 5.



Prostatic phoric electrode in bladder.



Prostatic phoric electrode in rectum.

CERVICAL

1 and 2, small rotators of head. (2 to 5, sterno-mastoid, upper neck, upper trapezius).
Depressors of hyoid bone. (6 to 8, lower neck, middle trapezius).
3, scaleni, levator angulæ scapulæ.
4, 5, diaphragm, pectoralis, serratus, elbow flexors, deltold. ,
6, 7, 8, pronators, triceps, wrist, hand and fingers. Reflex, scapular and pupils.

DORSAL

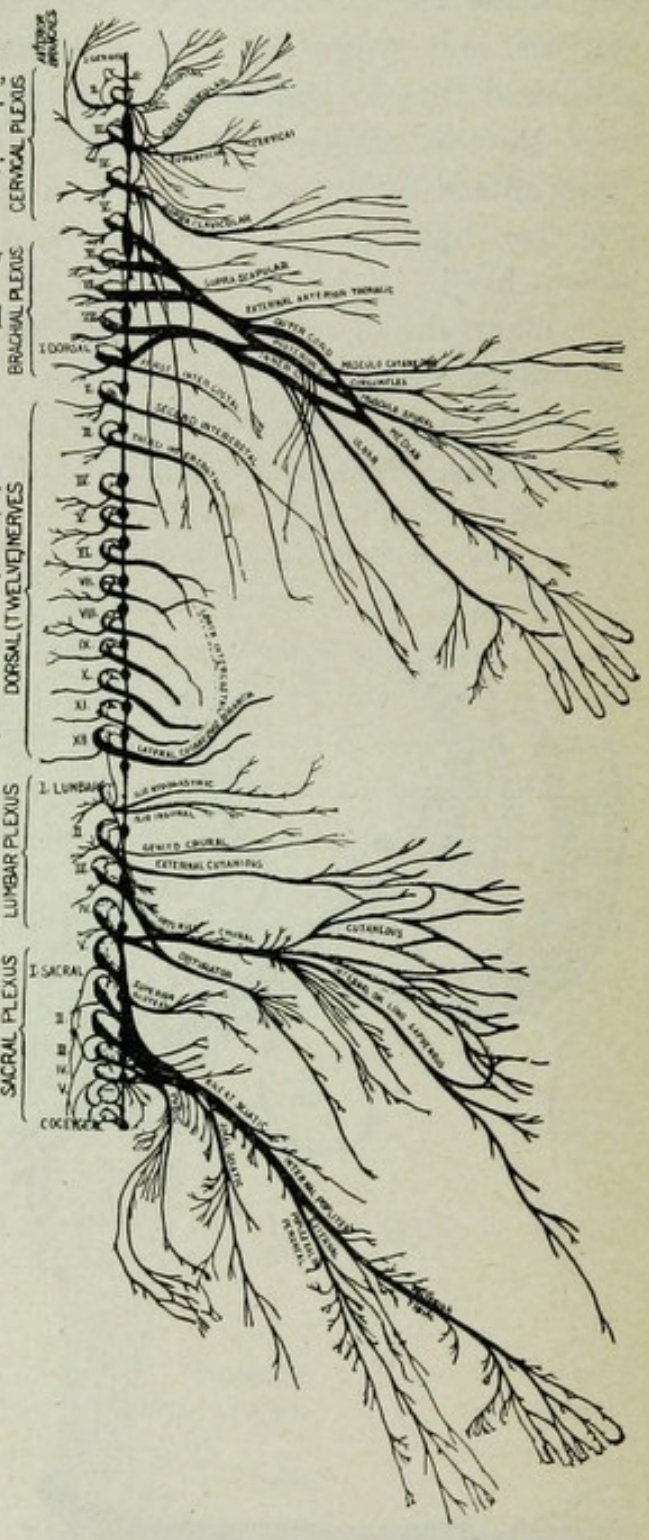
1 to 12, lower trapezius and back muscles.
1 to 10, intercostals. 7 to 12 and 1st lumbar, abdominal muscles and ileo-psoas.
Reflex, 4 to 7, epigastric. 8 to 12 abdominal.

LUMBAR

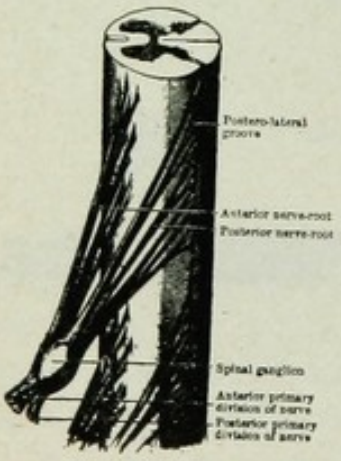
1, ileo-psoas, 2, 3, cremester, hip flexors. 3, 4, knee extensors, hip adductors.
4, 5, hip extensors and adductors. 5 and 1st sacral, knee flexors.
Reflex, 1 to 4, cremasteric. 2 to 4, patellar.
4, 5, gluteal. 5 and 1st sacral, foot clonus.

SACRAL

1, 2, intrinsic foot muscles.
3, 4, 5, perineal and anal muscles.
Reflex, 1 and 2, plantar.



ROOT AND ORIGIN OF THE SEVENTH CERVICAL NERVE



Of all the nerves most frequently affected, the seventh cervical is prominent, in all neurasthenic conditions. Pressure at the seventh cervical vertebra is painful, and positive galvanization gives prompt relief.

HEAD PAINS

In this country, where so many are afflicted with what the Europeans call Americanitis, meaning a condition of sub-acute or chronic nervous unbalance, due to our strenuous manner of life, headache is a still more common symptom than is dyspepsia, but we as physicians are not called on so much for the relief of this symptom as we would be, if it were not for the patent medicine habit which is so prevalent.

There is, however, a large and ever-increasing proportion of our clientele who are anxious to have us relieve, if not cure, this distressing symptom, and if there ever was need of careful diagnosis, it surely is in the determination of the cause of the headache, and then, knowing the cause, we have in some of the electric modalities, very frequently, a safe, sure and quick cure.

There is probably no simpler, yet more spectacular method of impressing the patient with the efficacy of proper electrification, than in the treatment for the relief of some form of headache.

As we have stated before, if it was not for pain, there would not be much call for doctors, in a large proportion of cases.

If a lady patient comes in complaining of a pain in the top of her head, and you tell her that she has uterine derangement, and mention a few other symptoms, which go with it, you have impressed her, and when you correct the pelvic trouble, and she has no more headache, then she is your friend and advertiser till the end of the chapter, and then when she tells another friend, with an ache in some other part of the head to take it to you, and you seat her on the static platform, and with a few passes of the static point spray across her forehead, and down the back of her neck, and in exactly two minutes she is free from pain, and goes out pleased, she does not forget to tell about it, and usually from the housetops, figuratively speaking. A few such well-directed cures of headache will make you "solid" with the community, oftentimes more quickly than any other way.

Now there are headaches and headaches, some of which are easy and others difficult to reach and cure, the result depending in a great degree on the cause.

I have in my office a handsome illuminated pen and ink drawing, the handiwork of a close medical friend, which is framed, and hangs above the mantel, where all may see it, which bears this legend in colors:—

> FIND OUT THE CAUSE OF THIS EFFECT,
> OR RATHER SAY, THE CAUSE OF THIS DEFECT,
> FOR THIS EFFECT DEFECTIVE COMES BY CAUSE.
>
> HAMLET.

I have tried to make this the rule of my work, and with some measure of success. Go, and do thou likewise.

The causes operating to produce headache as an effect are many, and may be divided into three general classes, thus:

1. Causes operating within the cranium.
2. Causes operating indirectly from a distance.
3. Causes operating from systemic poison.

The cranial cause may be cerebral anæmia or hyperæmia; thrombosis or embolus, in some vessel in the brain; inflammation resulting in cerebritis, meningitis, or cerebral abscess; caries or necrosis of skull bones; tumors of the brain or meninges; hemorrhages or blood clot; effusion; hydrocephalus; concussion or compression; foreign bodies; fractures of the inner or outer table of the bone; gummata or syphilis.

The indirect cause may be from derangement of the stomach, liver, kidneys or glands of the gastro-intestinal tract; some uterine or ovarian disease or displacement; pregnancy; constipation; mental emotions; loss of sleep; overwork; or sexual excesses.

The blood cause may be from fevers, malaria, diphtheria, syphilis, uræmia, cholæmia, pyæmia, septicæmia, anæmia, chlorosis, scurvy, purpura, rheumatism, narcotism, alcoholism, or drug addictions.

From this array of direct and indirect causes, we at once see the great importance of first finding out "the cause of this effect."

I am greatly indebted to the excellent works of Drs. Flower and Benson for the summarizing of the etiology and differentiation of headaches, which while not electro-therapeutic, are essential to know.

DIFFERENTIAL HEAD PAINS

SYMPATHETIC head pain is an indirect symptom, due to some derangement of the gastro-intestinal canal, or the genito-urinary tract, and is usually more severe after a night of rest, being complained of the first thing in the morning.

CONSTANT head pain is due to an excess of urea in the blood; lead poisoning; or from the administration of strychnine, quinine, alcohol, nitroglycerin, and other stimulants.

HEMICRANIA or neuralgic head pain is manifested by an acute darting character, usually on one side only, and being increased by pressure.

RHEUMATIC head pain is usually bilateral, in the region of the occipito-frontalis muscle, the pain being greater on motion of the scalp and neck, and sometimes affects the temporal and masseter muscles, rendering movement of the jaws painful.

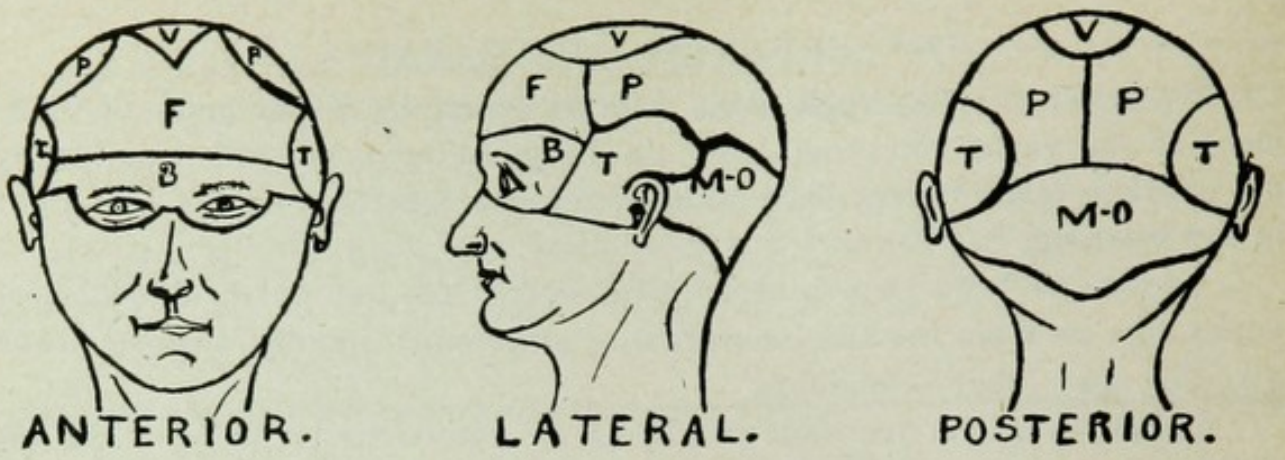
INFLAMMATORY pain in the head is very severe and constant, and is associated with constitutional symptoms, fever, vomiting and delirium.

IN ABSCESS, TUMORS OR SOFTENING of the brain and other chronic conditions, the head pain is persistent, and is confined to one spot, but not so severe as in the inflammatory kind, and only occasionally is paroxysmal, with mental disturbance and muscular inco-ordination.

CONGESTIVE head pain is of a dull, aching nature, is made worse by stooping or lying down, and by protracted sleep, or mental or bodily effort, and is attended with flushed face, throbbing carotids and heat in the scalp.

MENINGEAL head pain is constant and fixed, sometimes sharp and cutting, with frontal and occipital congestion.

ANÆMIC head pain is severe, but dull and transitory, with much lassitude and scalp tenderness, with no fever, but often there is ocular disturbance, and lack of power for mental concentration.



HEAD PAINS—LOCATIONS AND CAUSES

(Maps modified after Flower and Benson.)

TOPOGRAPHY

(From Benson.)

F. F. FRONTAL. When pain is located in the forehead, from the coronal suture to the superciliary ridges below, and within the temporal ridges on either side, *the large intestines and rectum are congested and overloaded with feces.* Also in gout and malarial diseases.

B. B. BROW-ORBITAL. When pain is located below the superciliary ridges including the orbit, to the external angular process on either side of the forehead, *there is irritation of the stomach and small intestines, or congestion at the base of the brain; or over the orbits; or nasal catarrh; astigmatism or other visual defects; decayed front teeth; but if the pain is located at and around the supra-orbital notch, there is irritation of the sympathetic and vagus nerves of the stomach from indirect causes, as in uterine and ovarian congestion, functional disturbance of the heart, lungs, etc., or congestion of the sheath of the supra-orbital nerve at that point, due to sudden exposure to cold.*

M. O. MASTOID-OCCIPITAL. When pain is located between the ears at the occiput, below the lambdoidal sature, *there is congestion at the base of the brain and medulla-oblongata, or defective supply of blood, or anæmia; or spinal irritability from excesses in venery or masturbation.* Also in malarial fever and mental anxiety.

T. T. TEMPORAL. When pain is located in the temporal fossa, from the squamous suture to the zygoma below, and from the temporal ridge to the mastoid process, *there is congestion of the cerebral meninges, or embolus of the meningeal artery, or inflammation of the internal ear.* Also in typhus and typhoid fever.

V. V. VERTECAL. When pain is located in the vertex, from the coronal to half the distance of the lambdoidal suture, and on either side of the saggital suture, to the superior line of the parietal eminence, *there is deficient blood supply to the superior convolutions of the brain, or indirect irritation from the uterus, bladder, rectum or organs of generation, catarrh of the eustachian tube, enlarged or diseased tonsils.* In nervous conditions from debility and exhausting discharges, overlactation, valvular diseases of the heart, hemorrhages, impoverished blood, albuminuria, etc. In hysteria with clavus hystericus, and in sympathetic, organic and neuralgic states, the pain is confined to one spot. Rheumatic head pain is confined to the occipito-frontalis muscles, *but if the pain is deeply seated, sharp, and radiating to the side of the cranium, occurring only at night or before rising in the morning, there is syphillis.*

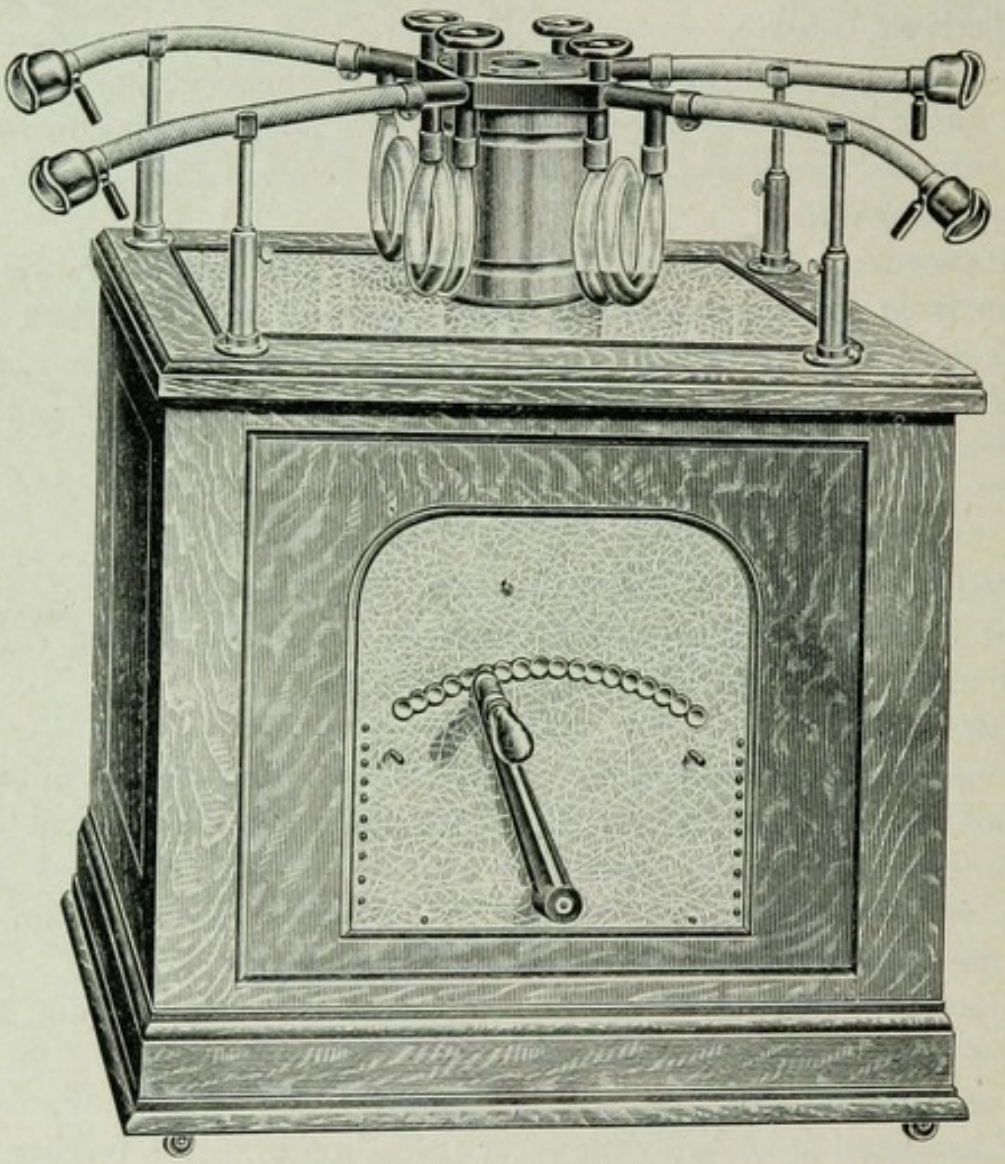
P. P. PARIETAL. When pain is located in the region of the parietal bones from the coronal to the lambdoidal suture, and from the squamous suture to the superior outline of the parietal eminence, *the liver, duodenum and small intestines are congested and there is constipation.* Also in malarial affections.

A careful study of the head maps, etiology, differentiation, and topography of headaches, knowing the cause, we can treat it and remove the effect, by means of proper electrification in some form.

Simple frontal congestive headache will disappear in a few minutes under longitudinal galvanization of the brain, with the positive to the front, and the negative to the back. Either placing the front electrode stabile, or passing it labile from side to side, without lifting it from the skin, will, in a short time, with a few milliamperes, cure the pain, by contracting the capillaries, and relieving the congestion.

Indirect headache, from excitement, sight-seeing, eye-strain, too close application of the eyes, with a poor light, or being too long in a bright light, or on a nervous tension, will be quickly cured by a minute or two on the static insulated stool, with the local point breeze to the forehead, or the overhead crown shower. (See pages 200-202.)

PURE BLOOD MEANS GOOD HEALTH
OZOL GAS MAKES PURE BLOOD



THE OZOL MACHINE

The masks are placed over the mouth and nose, and the patients inhale. This shows the simplicity of the treatment.

OXIDIZING THE BLOOD

THROUGH THE AGENCY OF ELECTRIFICATION IN THE TREATMENT OF DISEASE

The range of applicability of electrification in the treatment of disease becomes broader and broader as time passes. Wherever electrification is used, directly or indirectly, for the cure of disease, it is to be ranked as an electro-therapeutic agent. Any product of electrification that is used chemically must be classed with electro-therapeutics.

A product of electrification, known as ozol, by virtue of its merits, is now creating considerable interest in the medical world. The apparatus used in creating ozol consists of an electrical ozonizer, operated by an alternating mode of high potential power—about twenty thousand volts—but the volume of mode used is very small, being less than two amperes.

When the machine is in operation, a decided purple glow is to be seen in the ozonizers, and as the air is driven through the electrical discharge, there is a liberation of ozone. A pressure blower is connected directly to a motor, and after the liberation of nascent ozone it passes through the crescent shaped tube, partially filled with a mixture of pinus oils. Here the ozone and oils forms a new chemical compound, which has been given the name of "Ozol."

The identity of the ozone is lost in forming this new compound, both as to its irritating properties and odor and also chemical reaction. In producing ozol, none of the antiseptic or blood-building powers of the ozone are lost. These powers are increased to a marked degree through the agency of the terpenes.

Ozol contains no ozone in its free state. While free ozone is a powerful oxidizing agent, those who have experimented with it find that it is too irritating to the respiratory organs to be practical, making it impossible to use sufficient of it to oxidize the blood to any great degree.

The new compound gas is very agreeable to the sense of smell and the ozone is so disguised as to be unrecognizable in the product, ozol. The

pungency is so modified as to enable persons to inhale a ten times greater quantity of the new compound than it would be possible to take of the free ozone. Consequently, ozol has ten to one times greater oxidizing powers than ozone.

Oxidizing the blood has greater significance in the treatment of disease than the average physician is prepared to believe. In recalling our lessons in physiology, we are reminded that the normal temperature of the body is produced, and maintained, by the action of the oxygen we breathe upon the fluids of the body, causing combustion. Then, it is natural to conclude that persons, who have a sub-normal temperature, carry on an insufficient amount of combustion.

We have learned empirically that fresh air treatment is a great benefit to run-down persons, but just why such great benefits are to be derived, we have failed to give much thought.

As soon as oxidation to a part is diminished, that part begins to die, and becomes a suitable field of infection.

While much time and energy has been expended in obtaining the active principles of drugs for therapeutic purposes, but little thought has been given, heretofore, to ways and means of rendering the air more active for use as a curative agent. Heretofore, the world has been content to use air as Nature made it.

The late Dr. William D. Neel, of Chicago, rendered the profession a great service in inventing this active oxidizing agent. This gas is taken directly into the circulation, by inhalation, and produces wonderful effects upon the blood, by increasing the red corpuscles and hæmoglobin, and through its influence the quality of the blood is very much improved. Its action upon the vaso-motor nervous system causes all the organs to perform their functions better.

As organic lesions owe their existence to functional perversion, this treatment has a wide field of applicability.

I have, for some time past, been using the ozol method and have had it under close observation, and must say frankly that it produces wonderful results. Almost every form of functional disorder can be treated successfully by it, and it differs from the usual form of drugging, in that its effects are perfectly natural, the nerves being left calmed and pacific, while the muscular system takes on a feeling of buoyancy and exhilaration.

It differs from other nerve sedatives, in that it neither checks the secretions, nor depresses the vaso-motor action. It is very effective in eliminating waste products by all the channels. It increases the appetite and causes natural movements of the bowels, and its effect upon the kidneys is shown in the clearing up of deposits and re-establishing normal specific gravity.

Nervous tension, due to cerebral congestion, with restlessness, insomnia and melancholia, is effectually overcome. It establishes a permanency of vigor, and the nerve-wrecked or care-worn persons are made to realize its influence in an incredibly short time.

I have witnessed the most phenomenal and unbelievable results from the inhalations of ozol in the treatment of syphilis. Menstrual disorders of a functional nature yield to its influence promptly.

I will admit that I was not prepared to believe that so many persons suffer from disease, due to under-oxidation of the blood, as is evidenced by sub-normal temperature, until I begin to make observations with my thermometer. Neither was I prepared to believe that any agency could act so promptly in establishing a normal temperature, and, upon re-establishing a normal temperature, that functional derangements would disappear so quickly.

The conditions that I would mention especially, as being most amenable to this treatment, are such as neurasthenia, melancholia, insomnia, anæmia, asthma, hay-fever, bronchitis, early stages of pulmonary consumption, dyspepsia, constipation, headaches, inactive liver or kidneys, menstrual disorders, and syphillis in any stage, and I would say that it is a most valuable adjunct to surgical, electrical and other procedures, for the relief or cure of organic diseases.

This method is most rational. It appeals to both the physician and the patient, and the results produced are almost invariably satisfactory, especially if the disease has not reached a condition of organic disintegration.

I would suggest that the clinical thermometer be used more freely for the purpose of ascertaining the prevalence of sub-normal temperature, then to study what relation sub-normal temperature bears to functional diseases. As it has been a revelation to me, so will it be to others.

I submit the question of under-oxidation, with reference to its relation to disease; more particularly those which have a tendency to chronicity.

OXIDATION

PURE BLOOD AND DISEASE STRANGERS TO EACH OTHER

The preservation of health and prevention of disease is dependent almost entirely upon pure, healthy blood. Every organ, nerve, tissue and sinew of the body draws on this vital fluid for nourishment and strength. When the blood is not right, other things go wrong.

RESPIRATION. The object of respiration is to bring the oxygen of the air in close relationship with the hemoglobin of the blood and to permit of the elimination of carbonic acid gas (CO_2) from the body as well as other effete products in minute quantities.

In the process of respiration waste products are exposed to the action of the oxygen of the air, and they are burned up very much as if they were put into a stove, thereby producing body heat. In the living body, heat, whether tangible or not, is continually being generated through the chemical action of carbon and oxygen.

OXIDATION. When the blood receives sufficient oxygen to unite with the carbon in the proportion of two atoms of oxygen to one of carbon, carbonic acid gas (CO_2) is formed, which is in a suitable condition to be eliminated. The process of oxidation is complete, the body temperature maintained at normal (98.6 F.), the organs perform their functions properly and the system is in a condition to resist the toxic influence of micro-organisms.

When, however, an insufficient amount of oxygen is received by the blood, carbon monoxide (CO) is formed, which is not readily eliminated, and through its poisonous influences the system becomes debilitated or "run down," and trouble begins. Carbon monoxide is a deodorizer. It acts as an irritant to the nervous system, destroys hemoglobin, interferes with the functions of the organs, the body temperature is reduced below normal, which renders the system incapable of resisting the toxic influences of the various bacteria, and disease is the result.

A LOW TEMPERATURE IS NOT A NORMAL CONDITION. IT IS A DANGER SIGNAL

So prevalent is subnormal temperature among people "run-down," that nine out of ten of them will show a subnormal temperature by actual thermometer test. The clinical thermometer is the best means of determining the existence of under oxidation and should be used preferably mornings. . The temperature of one who is under-oxidized will be found to run from a fraction of a degree to three or four degrees below normal.

UNDER-OXIDATION. The under-oxidized and subnormal temperatured person will present one or more of the following symptoms:

Headache, backache, sleeplessness, dizziness, constipation, faint feeling, loss of memory, lack of energy, irregular appetite, stomach disturbances, coated tongue, puffy ankles, palpitation of the heart, heavy sediment in urine, cold hands and feet, numbness in limbs, flushing of face, excessive kidney action, disordered menstruation, visual disturbances, subnormal temperature.

From these symptoms we are justified in rendering a diagnosis of under-oxidation, taking on the definite form of either:—

Neurasthenia, constipation, liver disorders, kidney disorders, stomach disorders, intestinal disorders, uterine disorders, melancholia, hysteria, chorea, functional insanity, anæmia, chlorosis, sexual depression.

The symptoms or conditions that arise from under-oxidation of the blood are not necessarily in proportion to the degree of sub-normal temperature. A patient showing the fractional part of one degree of subnormal temperature may present as severe symptoms or condition of disease as one who is several degrees below normal.

OZOL FEEDS THE BLOOD. A sufficiency of an active form of oxygen for the blood means better blood, better circulation, better combustion, better equilibrium of body temperature, better vaso-motor activity, better digestion, better assimilation of food products, better elimination of waste products, less chance of auto-intoxication, better chance for body builders, and less chance for body destroyers.

ANTISEPTIC AND OXIDIZING POWERS OF OZOL

Scientists long ago recognized the great oxidizing and antiseptic powers of ozone, but owing to its irritating effects upon the respiratory organs, when used as an inhalant, little progress has been made with it in its free state in the treatment of disease.

We have succeeded in perfecting a machine whereby we convert the air into ozone and then convert the ozone into a new peroxide compound for inhalation purposes which we have named "Ozol."

The ozol machine is an electrical device, simple, embracing a number of newly discovered electrical principles ingeniously combined to accomplish a given purpose.

The ozol machine is constructed with the highest consideration for proficiency, regardless of cost.

The process of creating the new compound consists of electrical ozonizers of high potential power, the air being driven through the electrical discharge wherein it is converted into ozone which is passed through glass tubes of crescent shape, partly filled with volatile oils. Here the all-important chemical change takes place and the new compound gas thus formed passes through flexible tubes and is received by patients by means of moderately close fitting face masks. The gas is inhaled. The chemical union of the new gas with the waste products of the body produces thorough combustion, the body temperature is raised, waste products are properly eliminated, and a healthful condition of circulation is re-established.

In the new peroxide compound none of the oxidizing, antiseptic or blood-building powers of the ozone are lost. In fact, these powers are increased to a marked degree. The new gas thus formed contains no ozone in its free state. The identity of the ozone is lost as to its pungency, odor and chemical reaction. A combination of oils of the pinus group has been selected (eucalyptus, pine, thyme, etc.), which not only constitute an agreeable and effective inhalant, but are also recognized as possessing marked therapeutic value in the treatment of diseased mucous surfaces.

THE NECESSITY FOR OXYGEN

After careful analytical investigations of disease, it has been demonstrated:

First—That one of the most common and important conditions which the doctor is called upon to correct, is the weakness and incapacity produced by a diminished or impoverished blood supply.

Second—That under-oxidation produces bad health primarily, because of an insufficient supply of oxygen that makes certain the formation of carbon monoxide, which is at once a deoxidizer, a hemoglobin destroyer, and an irritant poison, devitalizing the blood and paving the way for

consumption, neurasthenia, hysteria, melancholia, functional insanity, menstrual disorders, excessive kidney action, sleeplessness, asthma, etc., and renders the system susceptible to a multiplicity of acute troubles, many of which run on to chronicity.

It has long been recognized that atmosphere possesses the properties of blood-building, oxidation and antisepsis. Ozol may be likened to a mixture of Michigan and Colorado air, electrified. Ozol differs from atmospheric air only in degree of activity and potency, and the ozol's greater action makes it the greatest blood-building, oxidizing and antiseptic agent within the reach of the medical profession.

It has been suggested that a subnormal temperature may be a normal condition with some people. This deduction can be controverted by placing any one with a subnormal temperature under the active influences of ozol when the temperature can be made to rise to normal.

MANY DIFFERENT DISEASES SUCCESSFULLY TREATED

Almost every form of functional, nervous, respiratory and blood disorders can be treated successfully by the ozol method, which differs from the usual form of drugging in that its effects are perfectly natural; the nerves being left calm, toned and pacific, while the muscular system takes on a feeling of buoyancy and exhilaration.

It is unlike so-called nerve sedatives. It does not check secretions or depress the vaso-motor system through the nerve centers, which fact is clearly shown in increased redness of skin, a feeling of warmth of the whole body and waste products being more freely eliminated. Increase of appetite is soon observed, regular and natural movements of the bowels are established, and the urine, cleared of its heavy deposits, assumes a natural color and specific gravity. Coated tongue, foul breath, heart palpitation, despondency, gloomy forebodings, cold hands and cold feet soon disappear. Persons arise in the morning feeling refreshed and free from headache, languor and pains. In cases of nervous tension, due to cerebral congestion, causing restlessness, insomnia and melancholia, it brings quick relief. It imparts a permanency of vigor to the whole system, and the jaded, nerve-wrecked, care-worn appearance of the patient is replaced at once by a cheerful countenance and it puts the patient in a frame of mind to talk approvingly about the treatment.

NERVE DISORDERS

The bad influences of under oxidation upon the nervous system are far reaching. It is the foundation stone of worry. Mental worry is the pit that catches countless thousands. The career of the under oxidized, mentally overworked is brief. Mental worry and sleepless nights are serious. So closely are neurasthenia and consumption associated that many scientists have declared that consumption is of nerve origin.

Nerve disorders disorganize the whole system. One organ after another begins to lag and fails to perform its function properly, and one symptom after another gives warning of existing disorders.

Ozol is prompt of action, in applicable cases, and no one appreciates its effects more than the patient.

It requires 30 to 70 minutes inhalation to saturate the blood, then the patient declines more.

The ozol method affords conclusive evidence that poor oxidation is the cause of many disorders by reason of the fact that when it brings the temperature up to normal, all symptoms disappear.

GET STRONG QUICK

In the slow recovery of strength, after long continued fevers, or other protracted illness, which depletes vitality, strength is rapidly restored and convalescence hastened by the ozol method.

Specific blood diseases soon respond to this remedy, and one experienced physician reports in three years symptomatic cures, without drugs, in thirty cases of syphilis, in all stages, treated by this method.

MENSTRUAL DISORDERS

Menstrual disorders are so common and so often overshadowed by more serious complications as to be often looked upon as only of secondary consideration, but it is safe to say that no physician using the ozol method to any extent, will fail to observe that it is a most certain and reliable regulator.

It acts with amazing promptness in amenorrhea, dysmenorrhea, hyperemia of the ovaries, and the hyperesthetic conditions caused by engorgement of the pelvic viscera. The two so-called "critical periods" of the woman's life, either in girlhood or middle age, at last find a satisfactory remedy in ozol. It effectually robs the climacteric of its horrors.

In the absence of atrophy, it is most reliable in re-establishing the normal functional activities of the genitalia.

THE DRUGLESS TREATMENT

The ozol method is a rational and agreeable departure from the older methods of dosing by the stomach.

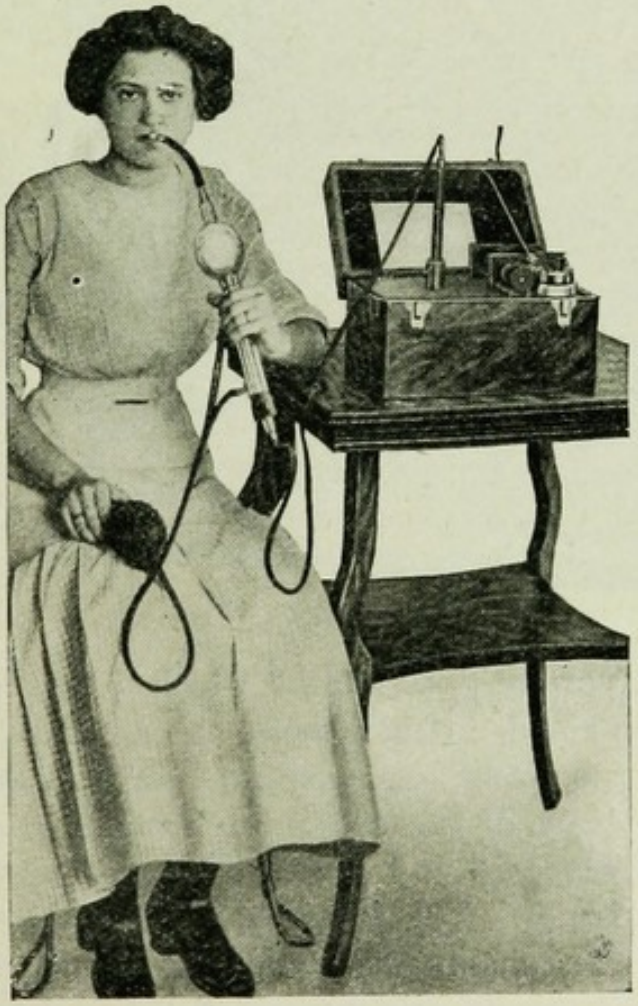
It does the work, unaided by any other remedy.

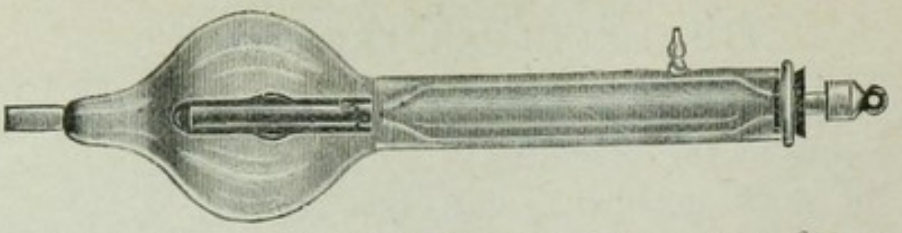
It is not ozone; it is the product of ozone and the essentials oils of the pine—a new gas, the formula of which is $C_{10} H_{18} O_3$.

It stands the severest test, not in one particular disease only, but in many widely different diseases.

It produces results, and that is what the physician recognizes as his greatest need.

PORTABLE OZOL OUTFIT

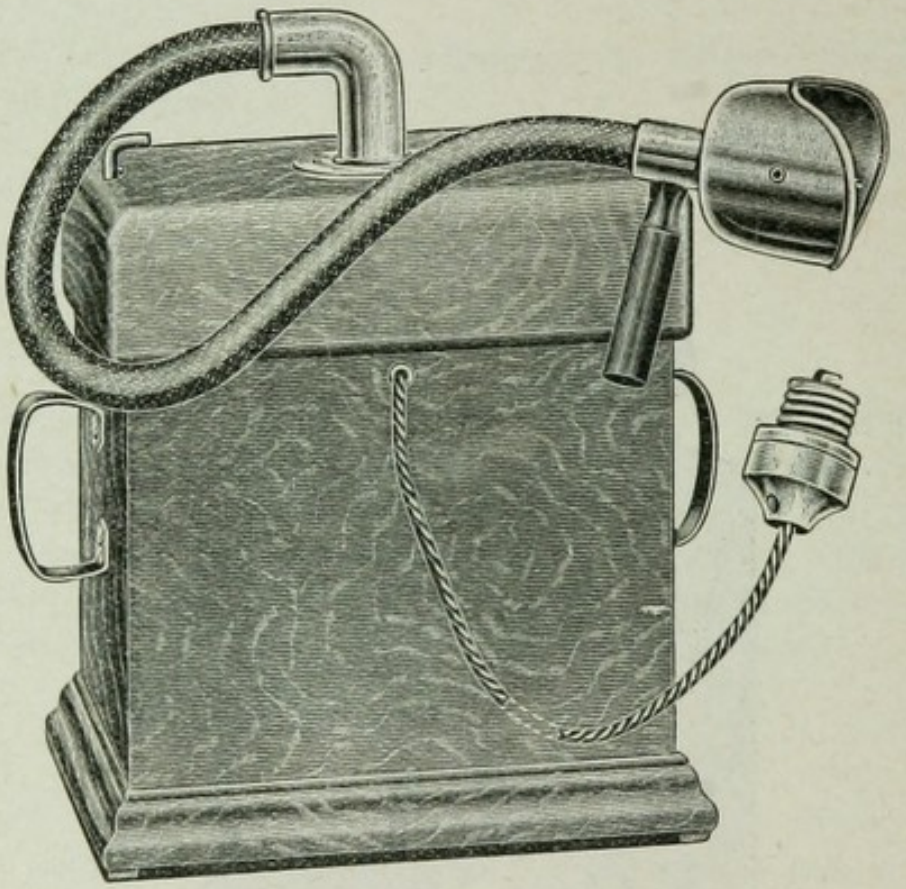




Ozone tube. For use with high frequency outfits or can be connected direct to any static machine.

The tube should never be used unless partly filled with pine needle and eucalyptus oil.

PORTABLE OZOL OUTFIT



This shows a portable ozol outfit which is compact, simple, inexpensive and self-contained, in that there are no attachments in the way of compressed air atomizers, or nebulizers, or rubber tubes, or fragile glass mixers. The body of the apparatus contains a condenser ozonizer, which is operated by a cord and plug being attached to the lamp socket of the alternating service. The upper part, which is removable, and to which is connected the inhaling tube and face mask, contains the mixing chamber, in which the terpene oils are spread over a large surface in direct communication with the ozonizer.



Hughes' ionizer. For delivering ozone by connecting either positive or negative from the static machine, or high frequency outfit. Connect with any atomizer, nebulizer or compressed air outfit. The inhaler should be placed to the mouth or nose.



Figure No. 1. Front view, showing extent of growth on Oct. 9, 1906.



Figure No. 2. Side view, showing extent of growth on Oct. 9, 1906.



Figure No. 3.—Side view, showing result of treatment on Feb. 22, 1907, after 40 X-ray, and 60 violet light treatments. Has perfect vision and good use of eye lid.



Figure No. 4. Showing condition over five years after operation. Functions all normal.

Post-Operative X-Radiation

I advise the removal of all exuberant malignant growths which are operable, as a preliminary step to X-radiation.

This lessens the danger of toxemia, and hastens the cure. I present a report of a remarkable case of encephaloma, in which the photographs speak for themselves.

No. 1 and 2 show imperfectly the awful condition, from a front and quarter view, when first seen, Oct. 6, 1906.

No. 3 shows fairly well the condition on Feb. 22, 1907, after the operation, and forty X-ray, and sixty violet light treatments, and sixty ozol inhalations.

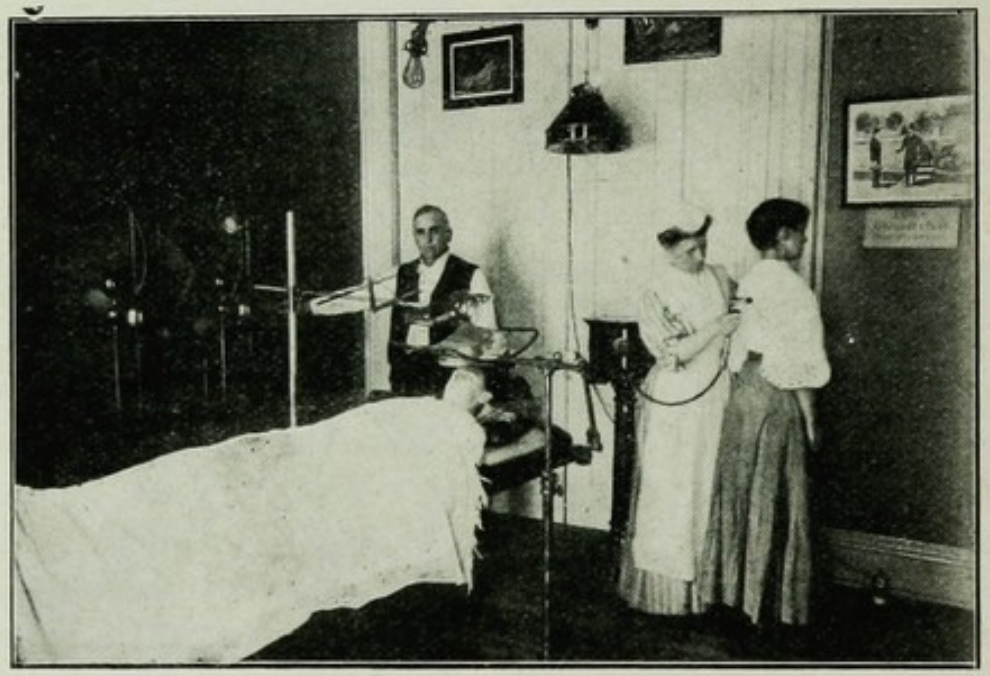
No. 4 shows the condition after four years and a half.

History. Miss R. K., came Oct. 9, 1906. Age 43. Single. American born, of German descent. Appears as in photographs Nos. 1 and 2. Duration 12 years. Was kept uncovered for nine years and grew to size of a silver dollar. For three years had been kept closely covered, and has grown so that the base measured, viz.:—vertical 3½ inches, longitudinal 4½ inches, diagonal 5½ inches, and the growth rolled over the base for at least an inch in all directions. (Growth in the thickest part, an inch and a half thick.) Completely surrounded and covered right eye, with lobes on both lids. Could distinguish light only by throwing head back, lifting upper lid and growth, and looking down.

December 10, growth removed by scissors, curette and dry gauze sponges. Larger parts torn off, smaller ones rubbed off, and base curetted. Moist dressings. After two weeks most of the skin had returned, and the growth was reappearing all over the base. Upper lid ¾ inch thick and no orbital depression. Could open eye about ¼ inch. Removed from hospital to sanitarium. Placed in direct sunlight for three days, and gave daily exposures to violet light.

Gave daily X-ray exposures for forty days, using a soft, old, chemically regulated tube, from ten to twelve inches away, energized by a Betz 24 plate

static machine. Began with six minutes, and followed with a 15 minute bath in the violet light from a Betz Russian 200 c. p. lamp, 30 inches distant. Protected surrounding healthy parts with an Allen aluminum adjustable shield. Also gave forty minute treatment with the ozol machine inhalations to enrich the blood. Gradually increased the length of the daily exposures till she took 17 minute X-ray and 25 minute violet light. Rapid disappearance of the returning growth. On the fortieth day a dermatitis suddenly developed to the second degree, which lasted for five days during which only the violet was used for 30 minutes daily. Mopped the area hourly with hamamelis, and gave an anodyne, and protonuclein every two hours to combat the toxin. I believe the violet light kept off the dermatitis for forty days, and controlled it and cured it in the five days from Feb. 8-13, and which was continued till the 60th day, when she went home.



Dr. Longcoy giving an X-ray treatment for cancer in Dr. Bennett's office.

She returned weekly for a treatment of X-ray, 15 minutes, violet light, 20 minutes, and ozol inhalation, 40 minutes, during six weeks; then fortnightly for eight weeks; then monthly for six months; then bi-monthly for a year; then tri-monthly for a year; then quarterly for a year; then semi-annually for a year.

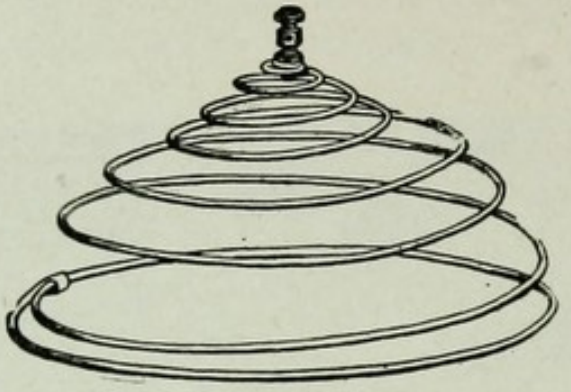
When last seen five years after the operation, she appeared as shown in No. 4. No scar or contraction anywhere. No hair in eyelids or brow on right side. Lids normal in thickness, and only slightly reddened at free margins. Can see well, and use lids perfectly, and tear ducts open. No pigmentation of skin, which is soft and pliable. Tanned all over face and

head by exposure in the sun. Wears no head covering about home, and is out doors when possible. Family history, immediate and remote is bad, there being several cases of unverified "consumption," "paralysis," and "cancer," in the blood relationship, with one in her direct line of descent, and whom she most resembles, so that this case is a possible fifth in the family. No other procedure, in such a condition, in this location, could have resulted as well as this. No microscopic examination was made, but I had in consultation, four surgeons and four physicians, who concurred in the diagnosis. Only one concurred in the plan of treatment, before, but all are satisfied now, and the photographs are eloquent. I have not seen anything to compare with it in extent, either in twenty-five years' practice or study of the literature.

Glossary of Electro-Medical Terms and Table of Contents Combined

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Abbreviations, Key 18



Abdominal Spiral Spring Disc Electrode, Bennett's.....38, 167

Absolute Unit of Current. A mode of ten amperes.....

Absolute Unit of Electromotive Force. The one-hundred millionth of a volt .....

Absolute Unit of Resistance. The one thousand millionth of an ohm .....

Acid, Bichromate Cell.....89, 91, 92

Accumulator. An apparatus to store electric energy, as the Leyden jar, and so-called "storage battery." Also applied to a disc covered with foil, attached to an X-ray tube.....104, 110

Action, Local. Chemical action that takes place in battery cells, consuming zinc without producing a working mode..... 87

Actinic Rays. The rays of light, or other forms of radiant energy that possess the power of effecting chemical decomposition.. 331

Activity. The work done per second by any agent.....

Active Electricity. Electrification in a state to exert attractive and repulsive powers or produce heat, light, shocks or decomposition. Free electrification .....

Activity, Unit of. Rate of doing work. One unit of work, performed in one unit of time, equals one unit of activity. In

the C. G. S. (centimeter-gramme-second) system, the unit of activity equals one erg per second. The practical unit in the same system is the watt, equal to one joule per second..... 443
Adherence. Steady attachment. Attraction of unlike magnetic or electro-static charges 311
Adhesion. The attraction that exists between unlike molecules...
Affinity, Chemical. The force that causes atoms to unite and form chemical molecules 161
Agonic Lines. Lines of no variation..... 112
Allen X-Ray Shield..... 289
Alternate Modes. Those in which the direction is changed at regular intervals 125, 128, 139, 141
Alternating Current. An electric mode that alternately flows in opposite directions 125, 139, 141
Alternation. A complete reversal of the mode.....139, 141
Aluminum Cell Rectifier.....128, 130, 133
Amalgamation. Coating zinc with metallic mercury..... 88
Ampere. The unit of mode strength, or the mode carried in one second, by the force of one volt, through a circuit where the resistance is one ohm.....83, 84, 86, 443
Amperage of Mode Strength.....83, 101, 102
$C = \frac{E}{R}$ — Current strength = Pressure divided by Resistance.....
Ampere Hour, Ampere Minute, Ampere Second. One ampere flowing for one hour, one minute, or one second respectively. The ampere hour is not a measure of energy, but when combined with the volt, and expressed in watt-hours, it is a measure of energy 86
Amperemeter or Ammeter. An instrument for measuring strength in amperes 94
Anaesthetic, Local 165, 365
Anaphoresis 159
Anatomical Topography 364
Anelectric.—a. Not becoming electrified by friction;—Opposed to idio-electric.—b. A substance incapable of being electrified by friction .....
Anelectrode. The positive pole of a voltaic or galvanic battery...
Anelectrotonus. The condition of lessened irritability which exists in that portion of the nerve nearest the + pole, after the mode of electrification has been passed through it for some time.... 160

Anemia. The deficiency in quantity or quality of the blood..... 379

Animal Electrification. Free electrification in the body. A misnomer .....

Anions. The corpuscles which collect around the + pole, when a compound electrolyte is decomposed by electrification..... 161

Anodal Electrolysis 173

Anodal Axis 281, 288

Anode. The "way" by which electrification enters. The positive (+) pole. The platinum electrode in an X-ray tube..... 271

Anode Rays. The rays from the anode or positive end of an X-ray, or vacuum tube.....277, 281

Annunciator. An electro-magnetic indicating device.....

Anti-Cathode 271, 277

Antiozone. Oxygen in a positive polar condition.....

Appliances, Electrical. This term is generally understood to refer to various belts, soles, jackets, etc., inclosing magnets, small cells or coils, to be worn on the person for various complaints..

Applications, Ten Static 197

Applicators—Electrodes 208

Arc. The spark or light made by a mode jumping from one conductor to another.....347, 349

Armature. An iron bar attached to the poles of a magnet to preserve the magnetic equilibrium. A coil of insulated wire on a soft core or wheel, revolved in a magnetic field, and in which a secondary mode is induced. The hammer, or vibration spring on an induction coil. The outer and inner coats of a Leyden jar 116, 192, 193

Arteriole. A small artery..... 379

Artificial Magnet. A bar of metal, originally without magnetic properties, to which magnetism has been imparted by another magnet 310, 311

Ascending Currents. Obsolete. The mode applied by placing the + electrode on the periphery of a nerve, and the — to the center 159

Asepsis. Freedom from septic matter or infection.....

Atom. A minute particle of matter..... 238

Atonic. Lacking tone .....

Atrophy. Wasting of a part.....

Attraction and Repulsion..... 161

Attraction, Magnetic. The attraction which a magnet exerts over other bodies 311

Auto-Condensation. A method of high frequency treatment, 245, 250, 305
Auto-Conduction. A method of high frequency treatment.....245, 250
Auto-Induction. A method of high frequency treatment.....245, 250
Axial Line. See Magnetic Axis.....112, 310
Axis Anodal 271, 281
Bachelet Magnetic Wave Generators. ... .319, 326
Back Pad Electrode..... 167
Back up a Spark..... 272
B. A. Ohm. The British Association unit of resistance.....
Base—A switch board. The part of a battery on which is fastened the meter, rheostat, coil, posts, switches or other attachments.
Bath, Electric Light 333, 334
Bath, Electro-Static 200
Bath, Electro-Vapor 178, 180, 337
Bath, Hydro-Electric 182, 183
Battery. The complete electrical apparatus, although, the cells are sometimes called the battery..... 93
Battery Cells 91, 92, 93, 99
Battery, Constant or Closed Circuit. One which, when the circuit is closed does not polarize very much.....87, 91
Battery, Dynamo. Two or more dynamos properly connected....
Battery, Electric. This is a general term given to the combination of two or more sources of electrification; two or more voltaic cells properly connected; two or more dynamos properly wired; or two or more Leyden jars, joined so as to give one single and united electrical discharge.....99, 101, 102
Battery Fluid. The acid solution for batteries. Electropoion fluid.
Battery, Gas. One in which gases constitute the voltaic elements
Battery, Magnetic. Several magnets connected.....
Battery, Plunge. One in which the plates may be removed when not in use.....92, 103
Battery, Primary. Several primary cells acting as one.....101, 102
Battery, Secondary. The combination of a number of secondary or storage cells 111
Battery, Storage. Several storage cells acting as one..... 111
Belt, Electric 143, 144
Bennett, Electrodes. Abdominal, Magnetone, Needle Holder, Soluble Set, Phoric.....38, 164, 167, 178, 212, 221, 293

Bennett Method of Static Vibration.....217, 221
Bichromate, or Red Acid Cell..... 91
Bidet Chair Light Bath.....340, 341
Binding Posts. Clamps of posts with a set screw, for connecting conducting wires or cords with electric apparatus or electrodes.
Bi-Polar. Attached to both poles of the apparatus..... 353
Blue-Stone Cell. A gravity cell, so called, from the sulphate of copper which it contains.....91, 93
Board, Switch. A board so arranged with switches that the circuits may be closed, opened, or interchanged.....97, 99, 137
Bobbin. An insulated coil of wire for an electro-magnet.....
Bound Electricity. Electrification which does not manifest its presence by any of the usual phenomena. This term is also applied to electrification "accumulated" or "condensed" in the Leyden jar 192, 193
Box, Resistance. A box containing a number of coils of wire whose resistance is known. Used in measuring resistance in circuits .....
Break and Make..... 115
Break. An opening in the circuit..... 115
Break. "To break" is to open the circuit and thus stop the flow of electrification. "To break" is the opposite "to make."..... 115
Breaker, Circuit. See circuit breaker.....96, 116
Breeze, Static 200
Bridge. The crossing of one conducting wire over another. Should be well insulated..... 99
Bridge, Wheatstone. Sometimes called an electric balance. An apparatus used in measuring resistance.....
Brush, Dynamo. Strips of metal which take off the mode from the dynamo .....
Brush Lead. Moving brushes forward to prevent sparking.....
Buckling. An irregular surface on the plates of storage cells caused by a too rapid discharge.....
Bugs and Beads. Dark moving spots seen on the surface of a fluorescent X-ray tube, which is not working properly.....
Bunsen Cell. A zinc-carbon couple, the elements of which are immersed respectively in electrolytes of dilute sulphuric and strong nitric acids .....
Button, Push. A circuit closer.....
B. W. G. Birmingham wire gauge, standard measurement of sizes and diameters of wires. The English standard.....

B. & S. The initials of Brown and Sharp, the Standard American wire gauge .....

Cabinet, Electro-Therapeutic, Bath 180, 183, 333, 337

Cabinet Battery 134, 136

Cage, Static 246

Calibrate. To determine the relative value of the scale of a galvanometer .....

Callaud Battery. Another name for the gravity battery..... 93

Callaud's Gravity Cell. A zinc-copper couple, the elements of which are used with electrolytes of dilute zinc sulphate, and a concentrated solution of copper sulphate, respectively..... 93

Candle Power. Usually expressed as C. P. The measure of the brilliancy of light emitted from any luminous body, expressed in units each of which is equal to the light produced by one standard candle 126

Candle, Standard. A candle of definite composition which, with a given composition in a given time, will produce a light of fixed and definite brightness .....

Capacity. An insulated conductor, as a patient on the static stool, auto-pad, or condensation couch. The capacity of a condenser (accumulator) is measured by the quantity of electrification of unit potential which it can contain..... 443

Capacity, Static 193, 443

Capillaries. Hair like blood vessels connecting the smallest arteries with the smallest veins..... 379

Carbon. A non-metal occurring in the various forms of diamond, graphite or "black lead," and charcoal, used as the negative element in a cell, and also used to coat the surface of rheostats. Also used as electrodes or terminals in an arc lamp.....85, 161

Carbon Dioxide. CO_2. A poisonous gas eliminated through the lungs. .....

Carbon Dioxide Snow. Under high pressure the gas liquifies on liberation and evaporation produces snow-like crystals which are moulded and applied to a growth that is to be removed. It is frozen and separates in 10 or 12 days without leaving a scar .....

Catalysis. The property of electrification which causes increased absorption and nutrition of the part treated, or the whole body, through its effect on the vaso-motor and sympathetic nervous system. A word introduced by Remak as a convenient term to designate a number of complex physical effects of electrifica-

tion. Under this term may be included phoresis, osmosis, electrolysis, the effect of the modes on the circulation of the lymph and the blood, and the trophic influences on the nerves. The chief action is indirect and physiological, and is the most important effect of any mode of electrification.. .....84, 152

Catalytic Action. (See catalysis)..... 84

Cataphoresis. The property of electrification which causes a transference of substance through moist tissues, by means of which medicines can be carried into the body. It is mechanical, and the property of the negative (—) pole only. Just the opposite of anaphoresis. The process of introducing medicaments into the body by the aid of negative electrification. It is sometimes termed electro-osmosis. The name cataphoresis is derived from cata = down, and pherein = to bear, i. e., liquid passes by diffusion through the partition in the direction of the mode. The process may be shown by using a weak solution of starch, and a weak solution of iodine, separated by a porous partition. The mode, on passing from the iodine to the starch, will carry some of the former with it, thus coloring the starch by chemical reaction with the iodine..... 159

Cataphoric Action. (See cataphoresis)..... 159

Catelectrotonus. The state of increased irritability of a nerve near the cathode, or negative (—) pole..... 160

Cathion. The ion which collects at the cathode, or negative pole. The cathion is the opposite of anion, q. v.....161, 238

Cathodal Electrolysis 173

Cathode. The "way" by which electrification leaves the body. The negative (—) pole. The concave aluminum electrode in a vacuum or X-ray tube. The negative (—) pole of the battery.

Cathode Rays. The rays from the negative end of an X-ray or vacuum tube 270, 271, 277, 281

Cautery. The electric cautery, or as it is often called, the galvano-cautery, is usually a platinum wire or blade heated by the aid of electrification, and used to burn or cauterize the tissues of the human body. (See galvano-cautery).....102, 103, 109, 146

Cell. The jar or container, holding the elements and the electrolyte 85, 91, 93

Cell, Voltaic. The combination of two metals, or of a metal and a metalloid, which when dipped into a liquid called electrolyte, and connected outside the liquid by a conductor, will produce a mode of electrification.....85, 91, 93

Cell Connections. (a) Series circuits. Compound circuits in which the separate cells are connected in one circuit by joining their opposite poles so the mode produced in each passes successively through the circuit. This is sometimes spoken of as connection for tension or E. M. F. (b) Parallel circuits or multiple arc. A compound circuit in which the separate sources are connected by one set of terminals, all the positive to one positive conductor, and all the negative to one negative conductor, viz.: in a zinc-carbon battery all the zincs together to form the negative terminal and all the carbons together to form the positive terminal. This is called connection for quantity or amperage.....99, 101, 102

Centimeter. The hundredth part of a meter, equal to 0.3937, or about ⅖ of an English inch. The unit of length. For its value see units..... 443

Central Galvanization. Method of applying the galvanic mode to the nerve centers.....189, 190

Centrifugal Current. A descending mode or from the trunk outward, toward the extremities..... 159

Centripetal Current. An ascending mode or from the extremities, inward toward the trunk..... 159

C. G. S. Units. Centimeter-gramme-second units which have been universally adopted by electricians. C. stands for Centimeter, the unit of length, which is one-hundredth part of a meter, and is equal to 0.3937, or about ⅖ of an English inch. G. stands for Gramme, the unit of weight, which is equal to 15.432 grains. S. stands for Second, the unit of time. Thus we speak of centimeter-gramme-second system, or the C. G. S. system..... 443

Charge of Electricity. The quantity of electrification in a body....

Charger. A small static machine of two plates used to charge a large static machine .....

Charging Galvanic Cells 189

Charging Static Machines 227, 234

Charging Storage Cells 111

Chemical Effects 156, 363

Chloride of Silver Cell.....91, 92

Chromo-Therapy 331

Circuit. The path traversed by a mode of electrification. Closed Circuit. A completed circuit, through the conductors, and patient. Ground Circuit. One pole used and the other pole connected to the ground. Open Circuit. A break or gap in

the metallic circuit. Short Circuit. A short metallic connection through wires or any good conductor.....87, 88, 99
Circuit Breaker. An apparatus for interrupting the mode. A rheotome 96, 116
Circle, Galvanic. This includes fluid, elements, and connections between the elements outside the fluid..... .....87, 88, 99
Clamp. An appliance for completing the connection between electrodes and conducting cords. Binding posts.....98, 116
Closed Circuit Cell. One from which the elements are to be removed when not in use, and in which they are to be placed, when used, to close the circuit. The ordinary acid cells are closed circuit cells.....92, 103
Closing Contractions. The muscular contractions produced at the instant the circuit is closed..... 356
Coagulum. A clot. .....
Coil, Induction. Coils of insulated wire, in which the mode is induced by the alternate opening and closing of a circuit, around a core, causing hysteresis.....116, 142. 301
Coil Primary 114, 115, 116, 301
Coil, Secondary 114, 115, 116, 142, 301
Coil, X-Ray 262, 268, 284, 298, 301
Collecting Plate. The electro-negative element of the pair, from which the positive mode comes. Called the collecting plate because the hydrogen and other products of chemical decomposition collect about it.....87, 88
Columbia Dry or Paste Cell.....91, 92
Combination Battery 121
Combination Cabinet 122
Combs. A row of sharp points in a static machine for collecting the mode from the plates..... 229
Commercial Modes 81, 125, 145
Commutator. A device for changing the direction of the mode. An alternator. A pole-changer.....97, 285
Compound Magnet. Several single magnets united; with similar poles adjacent 312, 318
Compression Diaphragm 304, 306
Concentrator. A single point electrode for localizing static sparks or breeze 201
Condensation, Auto 245, 250
Condensed Facts in Electro-Therapeutics.....12, 13, 14, 15
Condenser. An apparatus for accumulating or storing electric

energy on a small surface. As an insulated metal plate or ball, or Leyden jar.....192, 193
Condenser Electrode. A vacuum tube containing a metal disk which acts as one plate of a condenser, the tube wall being the di-electric and the body surface in contact, the other plate....
Conducting Cords 290
Conduction, Auto 245, 250
Conductors. A term applied to the electrodes and cords by which they are joined to the battery. Substances through which electrification will pass. (See resistance)..... 89
Conjunctive Wire of Arch. The wire joining the two elements of a galvanic pair, outside the cell.....87, 88
Connectors 98
Connections. The wires, metallic cords, binding posts, and all metals used to complete the circuit are included under this term 99
Constant Battery. A galvanic battery with two fluid or gravity cells 93
Constant Current. A galvanic mode from a constant battery..... 81
Contact Breaker. A device causing an electric mode to make and break its own circuit automatically..... 116
Contact, Metallic. A contact of a metallic conductor produced by its coming into firm connection with another metallic conductor .....
Continued Current. The uninterrupted galvanic mode..... 81
Continuous Electrization. The protracted applications made by belts, chains, etc., worn on the body.....143, 144
Contractions, Closing. Those produced at the moment of closing or making the circuit..... 356
Contractions, Opening. Those produced at the moment of opening or breaking the circuit... 356
Contradictions 157
Contra-Indicated. Not indicated .....
Controller, Current 134
Convection. The discharge of electrification attended by alternate attraction and repulsion of particles of air, and the materials floating in it .....
Convective Discharge. A mild static breeze or brush discharge from a point or brush electrode.....201, 202
Converter. The inverted transformer or induction coil used on alternating systems 146, 147

Copper, Hydro-Soluble, Electrodes.....175, 176, 177
Core. A bundle or soft iron wire, or a bar of soft iron used as a magnet, in the center of a coil.....114, 116, 314, 301
Corpuscles 238
Couch, Magnetic 328
Coulomb. The unit of measurement of electrical quantity..... 443
Couple, Astatic. Two magnets of equal strength suspended one over the other in the same vertical plane, with poles opposed so as completely to neutralize each other.....
Couple, Thermo-Electric. Two dissimilar metals which, if joined at their ends only, and connected to form a complete circuit, will produce an electric mode, when heated at the point of junction .....
Couple, Voltaic or Galvanic. Two dissimilar metals in an electrolyte which are capable of producing an electric mode..... 85
C. P. Abbreviation for candle power.....
Crookes Tube. A vacuum or X-ray tube, named for the inventor.. 272
Cross. A short circuit, make by two uninsulated conductors coming in contact .....
Cross, Electric. Accidental contact between two or more conductors .....
Crow-Foot Cell. A gravity cell, so-called from the shape of the zinc 91, 93
Crown-Breeze, or Shower..... 200
Cryptoscope. A fluoroscope 206, 271
Current, Alternate. A mode in which the direction is changed, at regular intervals 125
Current, Ascending. A mode applied by placing the anode, or positive electrode upon the periphery of a nerve, and the cathode, or negative electrode at the nerve center..... 159
Current Breaker. A device for opening and closing the circuit, a vibrator, a rheotome, an interrupter.....96, 116, 117
Current, Centrifugal. A descending mode flowing from the center to periphery 159
Current, Centripetal. An ascending mode flowing from periphery to center 159
Current, Constant. A mode from a constant battery galvanic; direct 81, 88, 94, 101, 108
Current Controller. A device or rheostat for controlling an incandescent mode 134
Current Density. The mode which passes in any part of a circuit

as compared with the area of cross-section of that part of the circuit 104

Current, Descending. Antithesis of the ascending current in that the cathode is on the periphery and the anode at the center.. 159

Current, Direct. A non-alternating mode; galvanic, constant..... 125

Current Direction 159

Current, Earth. Electric modes produced through earth, caused by a difference of potential at different points.....

Current, Eddy. Useless modes produced in metallic masses such as pole pieces, armatures, and filed magnet cores of dynamos and motors. They are caused either by motions through magnetic fields, or by variations in the strength of the electric modes flowing near them..... 314

Current, Electric. The quantity of electrification which passes per second through conductor or circuit..... 443

Currents, Electric. Modes, modalities..... 125

Current, Faradic. See faradic mode.....81, 113, 116

Current, Galvanic. The direct mode..... 124

Current, Induced. The mode produced in a conductor by cutting magnetic lines of force. When a discharged body is brought near another, but not in contact with it, the latter becomes electrified or possesses an induced charge. The faradic mode is often spoken of as the induced current..... 113

Current, Oscillatory. These modes flow periodically in opposite directions but not necessarily for the same length of time. The maximum values of successive waves change in a regular order. Oscillatory or fluctuating modes while pulsatory are unidirectional modes 139

Current, Pulsatory. These modes vary their potential in repeated cycles. They are unidirectional modes.....139, 140

Current Reverser. A pole changer. A commutator..... 97

Current Selector. A device for altering or changing the kind or strength of a mode..... 142

Current, Simple Periodic. Alternating modes. A mode of such a nature that the continuous variations of the flow past any cross-section of the conductor, or the variation of its electromotive force can be expressed by a simple periodic curve, such as a sine curve.....118, 139

E.

Current Strength. Amperage. $C. = \frac{E.}{R.}$ Current strength = pressure divided by resistance.

The product obtained by dividing the electro-motive force by the resistance. According to Ohm's law, the strength for a constant mode is:

$$\text{Amperage} = \frac{\text{Electro-motive force (volts)}}{\text{Resistance (Ohms)}} \quad \text{.....83, 101, 443}$$

Current, Transforming. Changing the electro-motive force of a mode by its passage through a converter or transformer..... 146

Currents, Undulatory. Modes, the duration and strength of whose flow gradually change.....118, 140, 160

Cycle. Two alternations. The round trip or circle of the mode, embracing one positive and one negative wave or alternation. A period of time within which the same phenomena regularly recur in the same order..... 141

Cycles. Ordinary alternating modes used in lighting service have either 7200 alternations per minute, (60 cycles per second), or 15,000 alternations per minute, (125 cycles per second)..... 125

Cylinder Machine. A form of static machine.....

Damper. A retarding device. A metallic cylinder surrounding the core of an induction coil, for the purpose of varying the intensity of the induced modes. A muffler.....116, 117

Damper, Arc Lamp. A dash pot or other device offering resistance to quick motion.....

Daniell's Cell. A porous cup containing dilute sulphuric acid immersed in a jar, containing a solution of sulphate of copper. The elements are copper and zinc.....

D'Arsonval Mode. One of high frequency, medium voltage, and high amperage. Applied by the bi-polar method, and by auto-condensation and auto-conduction 244, 251, 256

Dead Beat. This applies to the motion of a galvanometer needle, that moves sharply over the scale from point to point, and comes quickly to rest, instead of swinging to and fro..... 94

Dead Wire. One that is not charged with, or conducting a mode..

Death, Electro-Diagnosis of..... 351

Declination. The dip of the magnetic needle.....

Degeneration, Reaction of..... 356

Demagnetize. To take away magnetic properties..... 114

Demagnetization. A process through which a body may be deprived of its magnetism. One step in hysteresis..... 114

Density. The amount of electric energy accumulated on a unit of surface area is called "density." The term is also applied to a large quantity, or amperage, passing through or over a small

conductor, and the density of the mode—other things being the same—is proportional to the cross section of the diameter of the conductor, or to the superficial area of the electrode.... 104

Density, Magnetic. The magnetic strength as measured by the number of lines of force that pass through a unit of cross-section of the magnet.....

Depolarizer. Bichromate of potash or soda, put into an acid cell, or binoxide or manganese in an alkaline cell, to unite with the hydrogen liberated at the negative element, to prevent insulation, or polarization, by the formation of a film of the gas upon the surface 87, 89

Depolarization. Depriving a voltaic cell of its polarization. Removing bubbles of gas which collect on the negative plate..

Derivation Wire. A wire connecting two points in a closed circuit. A shunt circuit 109, 110

Derived Current. A mode drawn off by a derivation wire, from the main mode. A shunt circuit.....109, 110

Dermatitis. An inflammation of the skin; used to signify the inflammation produced by an overdose of the X-ray, or X-ray "burns." .....

Dermo Lamp 338

Descending Current. (Obsolete). Flowing from center to periphery 159

Detector, Ground. A device used in incandescent lighting. It is placed in the central station, and shows by the candle power of the lamp the approximate location of a "ground" on the system .....

Diagnosis, Electro 148, 351

Diagnostic Lamp and Box.....148, 307

Diagram of Cell Connections, By Battery Plate..... 99

Diamagnetic. Having the property of being repelled from both poles of a magnet, and tending to take a position with the larger axis across the line of the magnetic force.....

Diamagnetic Bodies. Bodies not susceptible of being magnetized..

Diasolenic 242, 243

Dielectric. Insulators across which electric action takes place, of which dry air is the most transparent and elastic. A substance which permits induction to take place through its mass. A non-conductor. The glass of a Leyden jar is a dielectric..... 112

Difference of Potential. When electrification moves or tends to move from one point to another, there is said to be a difference of potential between them..... 85

Diffusion, Interstitial Metallic..... 174
Diffusion of Current. The power of a galvanic mode to extend its influence in all directions, that power never being limited to the two electrodes, and being proportional to the conductivity of the body.....104, 106, 107
Dimmer. An adjustable resistance used in electric lighting, such as theater lighting, to regulate the brightness of the lamps...
Dip. See inclination.....
Diplopia. Double vision.....
Dipping, Electro-Metallurgical. A process of obtaining an electro-metallurgical deposit on a metallic surface by dipping it into a metallic salt solution.....
Dipping Needle. A magnetic needle. The compass needle.....
Direct Current. The constant dynamo or incandescent mode..... 124
Direct Static Spark..... 200
Disc, or Disk. The thin sheets forming the core of a laminated armature .....
Disc, Arago's. A non-magnetic metal disc, as of copper, which, when rotated rapidly under a freely supported magnetic needle, will cause the needle to be deflected or to rotate.....
Disc, Faraday's. A non-magnetic metal disc fixed on an axis parallel to the direction of the magnetic field in which it is to move .....
Discharge. The phenomenon which occurs in the equalization of the difference of potential between the terminals of a source of electrification when connected by a conductor.....
Discharge, Brush. The faintly luminous brush-shaped discharge which occurs at the negative electrode of a static machine.....
Discharge, Disruptive. A violent discharge which takes place across the intervening non-conductor.....200, 201
Discharge, Oscillating. Successive discharges and recharges which occur on the disruptive discharge of a conductor..... 200
Discharger. The instrument which directs the charge from a condenser through an object.....
Discharger, Universal. An apparatus for sending the discharge of a condenser in any desired direction.....
Disruptive Discharge. A violent static spark discharge, from a ball electrode 200, 201
Distance, Explosive or Sparking. The distance at which electrical sparks will pass through an intervening air space..... 200
Distributation of Electrification.....104, 106, 107

Downward Current. The term applied to the electric mode from the center to the periphery. See descending mode..... 159
Drop, Annunciator. A movable shutter or signal operated by an electro-magnet. When it drops, it indicates the closing of the circuit indicated.....
Dry or Paste Cell.....91, 92
Dryer for a Static Machine.....211, 232, 234, 235
Dynamic Electrification. Electrification in motion. It is opposite of static, which is electrification at rest..... 81
Dynamo. A mechanically driven machine which furnishes electrification in either direct or alternating mode, or both..... 124
Dynamo, Composite Field. A dynamo where the field coils are in series and separately excited..... 124
Dynamo-Electric Machine. Also called magneto-electric, are machines in which a powerful electric mode is produced by revolving coils of wire between the poles of a horseshoe magnet 124, 146
Dynamometer. A form of galvanometer. An apparatus for measuring the power given out or consumed by a machine.....
Dyne. The unit of force, i. e., the force which, if it acted for one second on a mass of one gramme, would, if the mass was previously at rest, give it a velocity of one centimeter per second; or if it was previously in motion in the direction of the force, would in that time alter its velocity by that amount..... 443
Ear Cup Electrode..... 166
Ebonite. A hard black substance composed of india rubber and sulphur, and used as an insulator. It possess high powers or specific inductive capacity 90
Effect, Joule. The heating effect produced by the passage of an electric mode through a conductor.....429, 443
Effect, Peltier. The heating effect produced by the passage of an electric mode across a thermo-electric junction.....
Effect, Thermo-Electric. The production of an electric-motive force at a thermo-electric junction by a difference of temperature .....
Effect, Voltaic. A difference of potential at the point of contact of two dissimilar metals.....85, 443
Efficiency, Electric. The useful electrical energy from any source divided by the total consumed energy..... 443
Efficiency, Real, of a Storage Battery. The ratio of the number of watt-hours taken out of a storage battery, to the number of watt-hours put into a battery in charging it..... 111

Effleuve. The fine spray from a vacuum tube or other electrode, too fine to be termed a spark..... 202

Electric Aura. A zone of electrified air..... 112

Electric Bath. This terms is applied to two methods of electrification. 1. Allowing an electric charge to be slowly drawn off or dissipated from an insulated patient by the surrounding air. 2. Electrizing a patient while in a water, vapor, or hot-air bath 182, 183, 184

Electric Belt 143, 144

Electric Brush. A wire brush used as an electrode.....61, 352

Electric Disks. See electrizers.....

Electric Endosmosis. When a porous diaphragm is placed in a liquid traversed by a continuous mode, the liquid will pass through the diaphragm in the direction of the positive mode. This process is electric endosmosis.....

Electric Fish. Certain fishes that give electrical shocks when touched. The best known are the torpedo or electric ray of the Mediterranean, the gymnotus or electric eel found in certain ponds in Surinam, and the malapterurus or electric shad of the Nile .....

Electric Fluid. This name was formerly given to electrification, in accordance with the theory that it is a subtle and imponderable fluid which permeates all bodies.....

Electric Force. This is the force with which electrification tends to move matter, and is not to be confounded with E. M. F.....

Electric Hand 258

Electric Machine. This term is usually applied to the apparatus for producing static electrification. See machine..... 199

Electric Moxa. A burn made on the skin by electrification; fulguration 269

Electric Potential. See potential 85, 443

Electric Residue. See residual charge.....

Electric Tension. Free electrification struggles to escape from the surface upon which it is accumulated, and this effort is termed tension. It may be considered a kind of pressure or strain acting from the center of a body outward..... 217, 221, 311

Electrician. One versed in the science of electrification in its relation to the arts. A term that is often incorrectly used instead of electro-therapeutist.....

Electricity. A condition 79

Electricity, Animal. Free electrification in the body .....

Electricity, Atmospheric. The free electrification in the air, which is generally positively charged, while the earth is negative. The atmospheric electrification is subject to perpetual changes, and occasionally is negative.....

Electricity, Dynamic. Electrification in motion..... 81

Electricity, Faradic. See Faradic mode.....117, 185, 354

Electricity, Galvanic. See Galvanic mode.....88, 94, 101, 108

Electricity, Static. Electrification at rest, nevertheless, while the static mode is described as electrification at rest, it is really electrification in a state of tension.....81, 191, 199, 217

Electricity, Magneto. Electrification produced by magneto-electrical induction, as by a magneto-machine..... 310

Electricity, Pyro. Electrification in certain substances when they are unequally heated or cooled. Tourmaline, which is a mineral, consisting of aluminum-boron silicate, and occurs in elongated crystals, shows it strongly.....

Electricity, Thermo. Electrification produced by a difference of temperature at a junction of two metals.....

Electricity, Voltaic. Electrical manifestations produced by the voltaic pile, cell or battery. The mode from an ordinary battery 81, 88, 94, 101, 108

Electrification. The manifest energy of the electric condition. The name of that which causes all electrical phenomena 81, 112, 191

Electrify. To communicate electrification to a body not previously exhibiting its presence. To charge with electrification.....

Electrine. Belonging to amber.....

Electrization. This term includes galvanization, faradization and franklinization 81

Electrizers. Metal discs of copper and zinc, or silver and zinc, applied to the surface of the body, and connected with a copper wire, exciting, with the perspiration, a feeble galvanic mode...

Electrocution. Legal capital punishment by means of a lethal dose of electrification. Also applied to accidental death from the same cause.....

Electrodes. The instruments fastened to the conducting cords, which are used in applying electrification. The terminals of an electric generator, or the poles in an arc lamp..... 208

Electrode, Positive. The electrode connected with the positive pole of a source of electrification.....106, 109

Electrode, Sponge. An electrode to which is fastened a sponge that is moistened. The sponge electrode is used very much in electro-therapeutics 167, 175

Electro-Biology. Electrical mode developed in living animal tissues by friction.....

Electro-Bioscopy. Testing the muscles by electrification, to see if life is extinct. The electro-diagnosis of death.....

Electro-Cautery. See galvano-cautery.....102, 103, 109, 146

Electro-Chemical Bath. The introduction and withdrawal of metals from the living body by means of a galvanic mode applied through a bath.....174, 183, 184

Electro-Diagnosis. The diagnosing of disease by means of electrification 351

Electro-Lithotrity. The disintegration of calculi in the bladder by electrification .....

Electrologist. One who makes a specialty of electro-therapeutics...

Electrograph. A print showing the effect of a static spark on a sensitized plate.....

Electro-Magnet. A mass of soft iron surrounded by a coil of wire.

Electro-Magnetization. The mode from a magneto-electric machine 114, 310, 312, 319

Electrometer. An apparatus for measuring differences of potential.

Electro-Motive Force. E. M. F. The voltage or pressure of mode strength, E. = C. X. R., or pressure = mode strength multiplied by the resistance.....83, 84, 86, 443

Electron. Amber 270

Electro-Negative Bath. Electrifying a patient from negative jar of a static machine..... 199

Electro-Otiatria. Electrification applied for the disease of the ear.

Electro-Pathology. See electro-diagnosis 351

Electrophorous. An instrument used to generate small quantities of static electrification, consisting of a pan of resin or sealing wax, to be rubbed with fur, and a metal plate with an insulated handle .....

Electro-Physiology. The effect produced on the healthy tissues of the living body by electrification.....154, 194

Electropodes. Divided plates of copper and zinc, attached to a flexible base, designed to be worn inside the shoes, under the soles. One kind of metal in each shoe. The action of the perspiration generates a slight galvanic mode.....

Electro-Poion Fluid. Acid battery fluid..... 89

Electro-Positive Bath. Electrifying a patient from the positive jar of the static machine..... 199

Electro-Puncture. The application of electrification, by means of needles thrust into the tissues. Electrostixis..... 172

Electroscope. An instrument for detecting the presence of static electrification, and determining whether it is positive or negative .....

Electro-Statics. That science which treats of static or franklinic electrification 193, 197, 199

Electrostixis. Electro-puncture 172

Electro-Surgery. The use of any form of electrification in surgical diseases. Electrolysis and galvano-cautery are the principal forms in which it is employed.....102, 103, 109, 146

Electro-therapeutics. The application of electrification to the treatment of diseases. (See electro-therapeutic index)..... 19

Electro-Therapeutist. One who is versed in the use of electrification in disease; incorrectly called an electrician.....7, 10

Electro-Thermal Bath 178, 180, 337

Electro-Tonic. The name given to the changing state of the conducting wires while the mode is forming or ceasing. The beneficial effect or action which electrification exerts or produces on the living organism. The name Faraday gave to the changing state of the conducting wires while the mode is forming or ceasing..... 16

Electro-Tonus. The peculiar modification of irritability which nerves and muscles undergo, when acted upon by a galvanic mode. The condition of a motor nerve when a continuous mode is passed along it. Electric balance or equilibrium of potential, constituting health. The altered activity in a motor nerve when subject to the action of electrification. It has two divisions viz: (a) Anelectronus. The condition of decreased irritability which exists in that portion of a nerve nearest the positive pole, after the mode of electrification has been carried through it for some time. (b). Catelectrotonus. The state of increased irritability of a nerve near the cathode..... 16

Electro-Vapor Bath 178, 180, 337

Electrolysis. A chemical decomposition. The process of decomposing a substance into its elemental gases by means of electrification. Separation, or analysis of compound chemical substances by electrification. Electro-analysis.....84, 169

Electrolyte. Any compound body composed of water and a salt, subject to electrolysis. The fluid contained in a galvanic cell..

Electrolytic. Relating to chemical decomposition produced by electrification 84, 169

Electrolytic Interrupter 299, 300

Electrum. This name is given to an alloy of gold and silver.....

Elements. The metals, or carbon and metals, immersed in the electrolyte, or battery fluid.....91, 161

Elimination. Carrying a substance out of the system by secretion, excretion, evaporation, exosmosis or diaphoresis; most easily effected through the skin by the electro-vapor bath..... 178

E. M. F. Electro-motive force; sometimes written simply E. It is the force that sets electrification in motion, or the difference of potential between two points, the transfer always taking place from the higher to the lower, i. e., from positive to negative 84, 86, 443

Endarteritis. Inflammation of the lining of an artery.....

Endosmosis. See electric endosmosis.....

Energy, Electric. The power which electrification possesses of doing work. It is generally measured in rate of doing electric work. The strength in amperes multiplied by the difference of potential in volts, divided by 746 equals the rate of doing work in horse-power. 746 volt-amperes, or watt—for a watt equals one volt times one ampere—equals one horse-power....

Energy, Electric, Transmission of. The transmission of mechanical energy between two distinct points connected by an electric conductor, by converting the mechanical energy into electrical energy at one point, sending the mode so produced through the conductor and reconverting the electrical into mechanical energy at the other point.....

Energy, Kinetic. Energy which is due to motion in contra-distinction to potential.....

Energy, Potential, or Static. Energy possessing the power of doing work, but not actually performing such work. Stored energy, or the power of doing work by a body at rest.....

Epilation, Electric. Removal of superfluous hairs by electrolysis. Also done by the X-ray..... 42

Equalizer. The metal rod connecting opposite sides of static plates, to equalize or neutralize waste charges..... 229

Equator. See magnetic equator.....

Erb Electrodes. Set 3 sizes..... 354



Erg. The unit of work; i. e., it is equal to the work required to

move a body through one centimeter, against a force of one dyne 443
Escharctic. Caustic .....
Essential Resistance. The internal resistance within a battery...
Explorer, Electric. An apparatus used for the purpose of locating metallic substances in the body, often used as a bullet finder..
Exposure Time For Radiographs..... 296
External Resistance. Resistance in the circuit outside the cell (non-essential resistance) .....
Extra Current. This name refers to (a) the appreciable mode in the primary coil which is due entirely to induction, and is partly galvanic and partly magnetic. (b). It is also given to modes taken from different layers of the secondary coil. (c). The transient modes in a coil, produced by the induction of each portion of the mode on the neighboring wires, on which it acts as if they were portions of another circuit.....
Extra Polar. Electrification is believed to be propagated within the tissues in every direction from the electrodes. Its effect upon those not between the two poles is called extra-polar....
Exudate. A substance deposited in or on a tissue, either by vital action or by disease.....
Eye-Cup Hydro-Electrode..... 166
Facts, Condensed, in Electro-Therapeutics.....12, 13, 14, 15
Farad. A million micro-farads. The unit of electrical capacity. Practically a capacity sufficient to overcome one coulomb of mode having a potential of one volt..... 443
Faradic Mode. Named for the discoverer, Faraday. Also called the induced, interrupted, secondary, to-and-fro, indirect, electro-magnetic, magneto-electric, and extra mode. The mode generated in a coil of wire by electro-magnetic induction..... 81
Faradic Induction. A mode of electrification passing through a wire, excites a wave of electrification in a second wire placed near to and parallel with it, at the instant of opening and closing the circuit.....113, 117
Faradism. Faradic electrification, employed as a remedial agent.. 81
Faradization. The application of the induced mode to a diseased part 81, 117, 185, 354
Fault. A failure in the proper working of a circuit.....
Fault, Localization of. Determining the position of a fault by calculation based on the fall in potential at different points of the line, or by loss of charge.....

Ferro Magnetic. Iron and similar bodies that are attracted by iron. Also called para-magnetic bodies.....

Field 112, 113

Field, Electro-Magnetic. The space traversed by the lines of force around a magnet; the space around a conductor carrying a mode which is pervaded by magnetic forces.....112, 314, 322

Field, Electro-Static. The region of electro-static influence surrounding a charged body.....

Field, Intensity of. The strength of a field as measured by the number of lines of force that pass through it per unit of cross section 112, 113, 314, 322

Field, Magnetic. The region of magnetic influence surrounding the poles of a magnet.....314, 322

Field, Magnetic Alternating. The magnetic field produced by an alternating mode 314, 322

Filament. In an incandescent lamp, the thread of wire or carbon which becomes luminous under the heating effect of an electric mode passing through it.....

Finder, Wire. A galvanometer used to locate the corresponding ends of different wires in a bunched cable.....

Finsen Light 338

Fluorescence. The property possessed by certain solids and liquids of becoming luminous under certain conditions. Under the influence of X-rays, crystals or calcium tungstate, barium platino-cyanide, quinine, willimite, calcium sulphide, and other minerals, become fluorescent. The greenish-yellow color on the surface of an excited X-ray tube.....

Fluoroscope. An apparatus with a fluorescent screen for examination with the X-ray.....206, 271

Flux, Magnetic. The total number of lines in any field. The number of lines of force which pass through a magnetic field..

Focal Point 271

Force, Coercive. The power of resisting magnetization or demagnetization 443

Force, Electro-Motive. The force starting, or tending to start, electrification in motion..... 443

Force, Electro-Motive, Absolute Unit of. The one-hundred-millionth part of a volt.....

Force, Counter Electro-Motive. An opposing electro-motive force which tends to cause a mode in the direction opposite to that actually produced by the source of electrification. In an elec-

tric motor, an electro-motive force contrary to that produced by the mode which drives the motor and proportioned to the velocity attained by the motor.....
Force, Magnetic. The force which causes the attractions or repulsions of magnetic poles..... 311
Foreign Bodies 352
Forming a Storage Battery Plate..... 104
Formula of Ohm's Law.....83, 86, 429
Fox Tail Discharge. A negative static phenomenon.....
Franklinism. Static electrification employed as a remedial agent.. 81
Franklinization. The application of the static mode to a diseased part 82
Free Electricity. Unbound electrification. That state in which it exhibits attraction and repulsion.....
Frequency. The number of complete cycles or alternations, occurring in a given time period, usually computed in seconds..... 141
Frictional Electrification. Electrification induced by friction; also known as static or franklinic..... 81
Fulguration. The production of a dry necrosis of tissues by means of a naked metal point electrode, used in connection with any high frequency mode, for removing small growths and blemishes; also as a post operative treatment in malignant growths, and in inoperable cases. A special insulated electrode is used in cavities..... 269
Functional. Pertaining to the natural action of a part, which may vary somewhat without any actual change in the structure of the organ or part.....
Fuse, Safety. A strip, bar, plate, or wire of lead or some fusible alloy, which automatically breaks the circuit, by fusing, on the passage of a certain amount of mode such as would endanger the safety of other parts of the circuit.....
Fustigation, Electric. The application of electrification through a metallic brush 61, 352
Galvanic Action. The corroding of plates and stays, supposed to be caused by modes of electrification being generated in a cell or jar. Termed, also, Voltaic action.....81, 85, 87
Galvanic Apparatus. Apparatus for generating and furnishing the galvanic mode 99, 100
Galvanic Battery. See batteries 91, 92, 93, 99, 100, 108
Galvanic Belt. An appliance for the continuous applications of galvanization, consisting of a series of small cells containing various elements 143, 144

Galvanic Chain. A series of links composed alternately of zinc and copper, to be worn around the body. The mode is generated by the moisture supplied by the perspiration.....

Galvanic Contractility. The contraction of muscles seen when we apply the galvanic mode.....56, 83

Galvanic Circle. This refers to a pair of elements immersed in a battery fluid, and connected outside the fluid. A single circle is one galvanic cell in action. A compound circle is two or more cells connected in series.....88, 94, 101, 108

Galvanic Current. Named for Galvani. A mode coming directly from the battery, not induced by a coil of wire, and called also, the continuous, constant, silent, direct and voltaic mode.. 81

Galvanic Discs. Discs of two dissimilar metals, arranged alternately, between which a communication is established, when moistened and placed on the skin.....

Galvanic Elements. Two dissimilar metals used in generating a mode of electrification.....85, 87, 91, 92

Galvanic Pair. See galvanic elements.....85, 92

Galvanic Pessary. An instrument for retaining the uterus in position, and at the same time, conducting to it a galvanic mode...

Galvanic Poultice. Minute pieces of zinc and copper, wrapped in cotton wool, each pair separated by flannel, all enclosed in a bag, one side of which is made of rubber cloth, and the other cotton. The cotton surface is applied next the skin, and the accumulated perspiration excites galvanic action.....

Galvanism. The form of electrification which is generated by chemical action. Voltaism 81, 355

Galvanization. The application of the galvanic mode to a diseased part 81, 355

Galvanization, General and Central.....189, 190

Galvanization Localized. An application of the galvanic mode limited to a particular muscle, nerve or organ.....104, 107

Galvanize. To affect by the galvanic mode.....

Galvano-Cautery. Also written galvano-causty. Burning or cauterization by an electric mode sent through a wire or plate of great resistance (usually platinum).....102, 103

Galvano-Cauterization. To burn with a galvanic mode.....

Galvano-Contractility. Muscular contraction produced by the galvanic mode 356

Galvano-Faradization. The simultaneous use of the two modes..

Galvano-Meter. An instrument for measuring the mode strength

or amperage. The strength of mode is calculated from the deflection of the needle..... 94
Galvanometer, Astatic. One having two magnetic needles so arranged that the earth's magnetism has little or no effect on them 94
Galvanometer, Ballistic. A form of galvanometer used to measure the strength of a mode that lasts but for a moment. The mode caused by the discharge from the condenser would be measured by it .....
Galvanometer, Dead-Beat. In this form of galvanometer the needle comes to rest quickly, instead of swinging to and fro...
Galvanometer, Marine. A form of galvanometer used on ships where the motion of magnetized masses of iron would seriously disturb the needles of ordinary galvanometers.....
Galvano-Plasty. (a) The art of separating chemical elements from their compounds by electrification. (b) The art of depositing metals by electrification, as in electrotyping.....
Galvano-Puncture 172
Galvanoscope. An instrument for detecting the presence and direction of a galvanic mode. A galvanometer..... 94
Galvano-Surgery. The application of the galvanic mode to surgery. It includes (a) electrolysis, (b) galvano-cautery..... 102
Galvano-Therapeutics. The application of the galvanic mode in the treatment of disease.....189, 190
Gaps, Multiple Spark 209, 287
Gap, Spark. The space between the prime conductors, as in a static machine, or on an X-ray or high frequency coil..... 287
Geissler Tubes. Vacuum tubes of glass, provided with platinum electrodes which are passed through and fused into the glass, and designed to show the various luminous effects of electric discharges through comparatively low vacua. A vacuum tube used for physical demonstrations of electrification, and static polarity 231
General Electrization. The application of electrification to all parts of the surface of the body during a treatment. We may employ any of the modes, Galvanic, Faradic, Sinusoidal, Static, High-Frequency, Magnetic, etc.....10, 185
General Faradization 185
General Galvanization 185
Generator, Motor 145, 146, 147
Generator, Pyro-Magnetic. An apparatus that will produce electrification when heat is applied.....

Generators. Electrification is said to be generated by batteries, (cells), dynamos or static machines, but it is not. All such generators produce only electric potential, pressure or electro-motive force, just as air or water pumps produce air or water pressure, not air or water.....

Governor, Current. A regulator arranged to maintain a constant mode strength in a circuit.....

Gramme. The unit of weight in metric system. It was intended to be exactly, and is very nearly, equivalent to the weight in a vacuum of one cubic centimeter of pure water at its maximum density. It is equal to 15.432 grains..... 443

Graphite. Lead pencils are made of graphite, which is a form of soft carbon, and is used extensively on rheostats.....95, 134

Gravity Batteries. Galvanic cells in which the elements are placed horizontally, the two fluids being kept separated by their different densities or specific gravities. Also called a crow-foot or bluestone cell.....91, 93

Grenet Cell. An early form of acid cell..... 92

Grid 104

Ground. The contact of an electric conductor and the earth..... 209

Ground Circuit. Connecting one pole of a battery or static machine, to the floor, water or gas pipe, by means or a wire, chain or cord..... 209

Grove Cell. A zinc-platinum couple, the elements of which are used with electrolytes of dilute sulphuric and strong nitric acids respectively .....

Hard Tube. An X-ray tube having a high vacuum.....275, 280

Harmonic Wave Current. (Sinusoidal)..... 118

Heat. An invisible radiation. Light, heat, and electrification may be different rates of motion, and lengths of similar waves of energy .....

Helios Lamp 347, 349

Helix. The coil of wires of the electro-magnetic battery..... 114

Hemoglobin. The coloring matter of the red blood corpuscles, containing iron 379-386

Henry. The name given to the practical unite of self-induction.... 443

Hertzian Waves. They were discovered by Dr. Hertz. They are a form of energy-waves traveling 186,400 miles per second....

High Frequency. A high frequency mode is alternating and oscillating in which the periods are so frequent or rapid, above 10,000 cycles, that they will not cause muscular contractions.

The voltage is very high, and amperage very low. (See D'Arsonval, Oudin and Tesla modes). Very high frequency is rather vibratory, not requiring a completed circuit..... 240

High Voltage. (See high frequency).....240, 241, 256, 259

Horse-Power. (Written H. P.) The commercial unit of power of doing work. This power consists of doing work equivalent to raising 33,000 pounds one foot per minute. An electrical horse-power equals 746 watts..... 444

Horseshoe Magnets. Magnets in the form of the letter U.....

Horticulture, Electrical. The process of exposing fruit, flowers, etc., to electric light during the night and the sun during the day. Dr. Siemens having tested this during later years, announced that the growth is twice as rapid as under other conditions .....

Hot Wire Meter. A thermostat used for measuring high frequency modes 263

Hydro-Electrization. Electrification applied by means of water as an electrode, as in a bath, or with a douche.....182-3-4

Hydro-Electrodes 166-177

Hydrostat. A device for preventing the spilling of fluid out of battery cells .....

Hygrometer 194, 215

Hyperæmia. An increased amount of blood.....

Hyperesthetic. Over sensitive .....

Hyperplasia. Abnormal increase in tissue elements.....

Hypertrophy. Overgrowth .....

Hypertension. Above normal blood pressure.....

Hypotension. Less than normal blood pressure.....

Hysteresis 114, 317

Idioelectric. Electric by virtue of its own particular properties; capable of becoming electrified by friction;—opposed to anelectric .....

Incandescence. The degree of white light given out by a body when intensely heated, usually by the electric mode.....

Incandescent Current. The constant mode or lighting mode of 110 volts or 220 volts, modified and used in medical treatments. Also the 52 or 104 volt, alternated street mode, which may be used with a rectifier, in electro-therapeutics..... 81

Inclination or Dip. The angle which a freely suspended magnetic needle, when parallel with the magnetic meridian, makes with the horizon. .....

Inclination, Angle of. The angle of magnetic dip.....
Inclination, Magnetic. The deviation of a magnetic needle from a horizontal position .....
Index of Electro-Therapeutics..... 19
Indican. A substance found in the urine as a result of imperfect intestinal digestion, (from proteid putrefaction).....
Indirect Spark 201
Induced Charge. When one charged body is brought near another uncharged body, but not in contact with it, the latter becomes electrified, or possesses an induced charge..... 113
Induced Current. See faradic mode.....113, 115
Inducing Current. See primary mode.....113, 115
Inductance. The phenomenon of induction.....113, 115
Induction. The process of exciting electrification in any object by bringing it near to, but not in contact with, a circuit through which a mode is passing. The generation of an electric mode in a body or conductor by the influence of another electrified body 113, 115, 443
Induction Coil. The coarse wire coil through which the primary mode passes. Also secondary fine wire coil outside, through which the induced mode passes.....113, 116
Induction. Electro-Static. The charge produced when the conductor enters an electro-static field.....
Induction, Self. The induction of a mode flowing in each portion of a circuit on neighboring convolutions of the same coil. When the mode is started, stopped, or varied in any manner, the induction occurs.....
Inductorium. An induction coil, which may be electrified by either a dynamic, static, high frequency, or magnetic mode..... 301
Inhibitive. Soothing or arresting a process or function.....
Initial Charge. A charge excited on glass or rubber, and conveyed to the plates of a static machine, by contact. (See charger)..
Insulating. Supporting or surrounding a body by an insulator....
Insulating Stool or Platform. A stool or platform which has glass or rubber legs. Any stool, platform or chair may be insulated by glass tumblers or saltcellars 200
Insulation. Non-conducting material, placed over or around a conductor to prevent the escape of electrification..... 90
Insulation, Static 197, 200
Insulator. Any substance which hinders the passage of electrification. It is the opposite of a conductor..... 90

Insulators 90
Intensifiers 296
Intensity. The energy or effectiveness with which electrification acts, often wrongly used instead of quantity, amperage or mode strength .....
Intensity, Magnetic. The amount of force with which a magnetic needle is brought back to its natural position when moved out of it. The same term is applied to the power with which a magnet retains its hold upon attracted objects.....
Interpolar Effects 105, 107
Interrupted Mode. A mode that is alternately opened and closed..
Interrupted Direct Static Mode..... 201
Interrupters, X-ray Coil.....299, 300
Interstitial Diffusion 174
Intra. Within .....
Intra-Ocular. Within the eye.....
Intra-Rectal. Within the rectum.....
Intra-Vaginal. Within the vagina..... 21
Inverse Current. An ascending or centripetal mode from the periphery towards the center..... 159
Ions. Elements into which a substance is divided or decomposed by electrolysis. The products of decomposition in electrolysis; the ion which collects at the positive pole is called the ANION, while that at the negative pole is the CATHION, quod vide. Faraday called them "ions" or "travelers." A moving particle of electrification.....160, 238
Iritoscope. A fluoroscope 271
Jar, Leyden. A static condenser in the form of a glass jar. There must be both an outside and an inside coating of metal which reaches to within three inches of the top. Through the cover of the jar there extends a brass rod with a knob at the upper end, and a chain at the lower. The chain makes contact with the lower portion of the inner coating. The coverings and linings are called armatures.....192, 193
Joule. The unit of work, in the C. G. S. system, and is represented by the energy expended in one second, by one ampere passing through one ohm, and = 0.738 pounds.....429, 443
Juice. A common commercial term applied to electrification.....
K. A symbol for electro-static capacity.....
Kathion. Another spelling of CATHION.....161, 238
Kathode. Another spelling of CATHODE. The cathode, or negative (—) pole.....105, 161

Keeper. See armature 116, 192, 193
Key to Abbreviations 18
Key, Discharge and Charge. When we wish to pass the discharge from a condenser through a galvanometer for measurement, we use this form of key .....
Key Plug. A metal plug inserted between two metal plates to bring them into circuit .....
Key, Telegraph. A simple switch by means of which the hand is enabled to open and close the circuit of a telegraph line to produce the Morse alphabet .....
Knife-Switch 111
K. W. The initials of kilowatt, which means one thousand watts.
L. The symbol for the co-efficient of induction .....
Labile Application. Moving one or both electrodes over the surface, instead of being kept in one place. It is the opposite of stabile .....
Lamp, Arc. The electric lamp which uses a pair of carbon sticks to produce light .....
Lamp, Incandescent. A form of electric lamp using a glass globe from which nearly all the air has been exhausted. Inside the globe we find a filament of carbon, platinum, or tungsten, the heating of which to incandescence produces light. The tungsten is the latest and best form of incandescent lamp, its only drawback being that the tungsten filament is very fragile and easily broken. A curious feature of the tungsten filament is that, when heated, the lamp may be handled with less danger of breaking the filament 111
Lamp, Inclosed Arc. In this electric lamp a small glass globe encloses the ends of the carbons .....
Latent Electricity. Passive, bound, or natural electrification. That form of electrification which does not manifest any of the properties peculiar to it .....
Law, Ohm's 83, 86, 429
Laws of Magnetization 311
Leads. The conductors used to distribute electrification .....
Leakage, Electric. The loss of mode due to poor insulation, or to induction .....
Leakage, Magnetic. The dissipated lines of magnetic force which form what is known as a stray field .....
Le Clanche Cell. The first form of sal-ammoniac cell, with a porous clay cup around the carbon 91

Legal Ohm. The resistance of a column of mercury one square millimetre in cross section, and 106 centimetres in length, at the temperature of O° C, or 32° F.....

Lesion. A disease or diseased area.....

Leucocytosis. An increase in the number of white blood cells....

Leyden Jars. The ordinary form consists of a glass jar or bottle, with an outside and inside coating of metal, usually foil, covering the bottom, and the sides from four to six inches up, with an insulating cap or stopper, fitting the top or neck, and supporting a brass rod, terminating above in a knob, and below in a chain which touches the bottom inside coating of the jar. This is used as a condenser or accumulator of electric energy..

Light Bath, Electric. (See photo-therapy).....333, 334

Light, Maxwell's Theory of. This theory is that light and magnetization are produced by motion of ether waves. It is supposed that light is produced by oscillations, and electrification and magnetization by rotary motion.....

Limit of Saturation..... 116

Line of Force at Any Point. The direction in which the charged body placed at that point tends to move.....112, 311

Lines of Flow. The direction of a mode passing through a conductor have been demonstrated to be in curves similar to the lines of magnetic force.....112, 311

Lines of Magnetic Force. The curved lines through which the force emanating from a magnet acts.....112, 311

Liquid, Electropoion. A liquid for a galvanic battery. The composition of this fluid is given, in the body of the text, under electropoion fluid 89

Live Wire. One that is charged with, or conducting a mode...

Local Action. Decomposition of zinc in the battery fluid when the elements are not connected.....85, 87

Local Anæsthetic 165

Local Effects on Elements.....85, 87

Local Electrization. The application of electrification to a single organ, muscle, or nerve, with a stationary electrode..... 107

Lodestone. Iron ore naturally magnetized. Impure iron oxide..

London Hospital Lamp.....338, 344

Loop, Drip. A loop of electric wires just where they enter a building and designed to prevent water following along the wires into the building.....

Loop, Electric. A loop used to bridge a break in a main circuit..

Low Frequency. A mode in which the alternations cause contractions of single muscles, usually painful. The Voltaic alternation mode is an example..... 263
Machine, Electric. According to common usage this term refers to the apparatus for generating static or franklinic electrification, and also the magneto-electric or dynamo-electric aparatus. Strictly speaking, this term applies to all batteries or devices for generating electrification..... 233
Magnet. A bar of steel or iron, to which the peculiar properties of the lodestone have been imparted of attracting or repelling other similar bodies.....310, 329
Magnet, Armature of a. A bar of soft iron placed across the ends of a horse-shoe shaped magnet to prevent dissipation of the magnetization 116, 192, 193
Magnet, Electro. A body which is a magnet only while a mode of electrification is being passed through it. See under Faradism in the general text..... 115
Magnet, Permanent. Usually a piece of hardened steel which retains its magnetization for a long time..... 310
Magnetic Axis. The line joining the poles of a magnet..... 115
Magnetic Couch 328
Magnetic-Electrification. Electrification set free by the action of a magnet 81, 310
Magnetic Equator. The line of no dip. An imaginary curved line connecting those points on the earth's surface where the dipping needle remains parallel with the horizon.....
Magnetic Field. Any region within the influence of a magnet and included within its lines of force.....314, 319, 322
Magnetic Induction 311
Magnetic Meridian. A great circle parallel with the direction of the magnetic needle, and passing through its poles..... 115
Magnetic Potential. The potential of a magnetic pole is of precisely the same nature as that due to an electrified body at that place. See potential 310
Magnetic Substances. Iron, nickel, cobalt, oxygen, and all other substances to which the properties of the lodestone may be imparted 310
Magnetic Wave Generators, Bachelet's.....319-326
Magnetism 82, 310
Magnetism, Ampere's Theory of. He assumed that the phenomena

of magnetism are due to the presence of electric modes in the atoms of substance that are capable of being magnetized..... 310
Magnetize. To communicate magnetic properties to substances that do not exhibit them..... 310
Magnetization 82, 112, 310
Magneto-Electric Machine. See dynamo-electric machine.....
Magneto-Electrification 112, 312, 326
Magnetometer. A reflecting galvanometer, used to measure the intensity of the earth's field.....
Magneto-Therapeutics 312, 323, 326
Magneto-Tonus 312
Magnetones, Bennett's 312, 318
Make and Break..... 115
Malingering, Diagnosis of..... 352
Maps of Body Pains.....368, 369
Maps of Head Pains..... 376
Maps of Skin Areas of Pain.....368, 369, 376
Massage Roller Application.....77, 206
Medium Frequency. A mode in which the alternations are slow enough, usually below 10,000 cycles, to cause painless contractions of sets or groups of muscles. The sinusoidal is an example 139
Metabolism. The process of changing inorganic materials into living cells .....
Metallic Electrolysis 173, 174, 177
Metallurgy, Electro. The science of the electrical treatment of metals .....
Meter, Milliampere 94
Micro-Farad. Practical unit of capacity. A condenser of one micro-farad capacity would contain about 300 circular sheets of tin-foil separated by mica plates, and would be contained in a box 3¼ inches deep, and 6½ inches in diameter.....
Micrometer, Arc. A micrometer used to measure the distance between the electrodes.....
Microphone. A telephone instrument used to render slight sound audible 319
Milliampere. The unit of medical electrification. The one-thousandth part of an ampere..... 46
Milliampere Meter. A meter for measuring electrification in milliamperes 94
Minin Violet Light Outfit.....341, 349
Modality. Any one of the different forms of electrification modes.

Mode. Same as modality.....

Molecule 238

Monopolar. Connected to one pole.....258, 260

Motor, Electric. A machine which changes electrical power into mechanical power; it may be a direct or an alternating mode motor. The direct is more largely used..... 147

Motor-Generator 146, 147

Motor-Points. The points on the surface of the body where the various branches of the motor nerves supplying the muscles may be best affected by and where a contraction may be produced by the minimum dose of electrification.....357, 361

Moxa. See Electric Moxa..... 269

Muffler 116, 117

Multiple, or Multiple Arc. We say cells are connected in multiple, or parallel, when all the positive poles are connected to form one positive pole, and all the negative poles to form one negative pole. This is the opposite of being connected in series.

Multiple Spark Gaps.....209, 287

Multiplier. A coil of wire through which a galvanic mode is passed, to increase or multiply its effect upon a magnetic needle played about it..... 113

Mutual Action of Two Currents. Two modes moving in the same direction repel each other; moving in opposite directions they attract each other.....

Myelecyte. A pathological white blood cell found in lukemia.....

Natural Electricity. When electrification exists in such a form that its equilibrium must be disturbed before its presence is manifest, it is called natural electrification.....

Neutral Point. A point midway between the poles of a magnet to which iron filings will not adhere, and which exerts no signs of magnetic force.....115, 314

Needle Holder, Bennett's..... 178

Negative. The difference between negative plate and negative pole is fully explained in the part on Galvanism, in the general text 85, 87

Negative. The sensitized plate which has been exposed to the X-ray, from which the positive radiographs are printed..... 296

Negative Breeze 201

Negative Electrification. Originally referred to that form of electrification developed by rubbing sealing wax with fur. Electrification from any plate, condenser or element which affects

the electroscope in the same way as sealing wax, is called negative .....

Negative Electrification. That which is generated by the friction of fur on wax, also called resinous electrification.....

Negative Element. The portion of the carbon, copper or platinum element immersed in the battery fluid, is electro-negative. The zinc element from which negative electrification is obtained, is however, usually spoken of as the negative element 85, 87

Negative Pole. See Cathode 161, 363

Negative Pole Effects..... 363

Nerve Distribution and Origin..... 372

Neurosis. A nervous disease, especially a functional one.....

Non-Conductor. Any substance that does not freely transmit electrification, such as glass, paraffine, rubber, etc. An insulator..

Non-Electric. Those substances which permit electrification excited on them by friction, to escape as excited or formed.....

Nutritional Effects 153, 363

Ohm. The unit of resistance. The ohm represents the opposition offered to the passage of a mode of electrification through a column of mercury, 106.3 centimeters long, and one square millimeter in cross section, and 14.4521 grammes in mass, at freezing point, (O°. C. or 32° Fah.), or in simple terms, about equal to the resistance of a cylindrical wire of pure copper, 250 feet long and 1/20 of an inch in diameter. The formula is.

$R. = \frac{E.}{C.}$ Resistance = pressure ÷ by current strength..... 83

Ohm's Law. The law devised by Ohm for determining the mode generated, and the amount of work it can do under given conditions; when the force of the battery, and the resistance of the circuit is known. One volt will force one ampere through one ohm, in one second. Thus:

$$\text{Ampere} = \frac{\text{Volt}}{\text{Ohm}}, \quad \text{Current} = \frac{\text{Electro-motive force}}{\text{Resistance}}, \quad C = \frac{E}{R} \ldots.$$

From this law we get the following equations:

1 volt × 1 ampere .....= 1 watt
1 volt ÷ 1 ohm .....= 1 ampere
1 ampere × 1 ohm .....= 1 volt
1 ampere × 1 second × 1 ohm.....= 1 joule
1 ampere × 1 second .....= 1 coulomb

Ohm's Law. Shown with a 16 c-p lamp.....83, 86
A 55 volt lamp has 55 ohms resistance and uses one ampere.
A 110 volt lamp has 220 ohms resistance and uses ½ ampere.
A 220 volt lamp has 880 ohms resistance and uses ¼ ampere.

Ohm Meter. An instrument for measuring ohms.....

Open Circuit Cell. One in which the elements are left all the time, whether in use or not. The LeClanche, paste, silver and gravity cells are all open circuit cells.....91, 92, 93

Opening Contractions. Muscular contractions produced by opening or breaking the circuit..... 356

Orificial. Pertaining to one of the openings or orifices of the body.

Orthodiagram. A tracing made on a paper laid on a fluoroscopic screen, on which is cast the shadow of some part of the body, by means of which the relative positions and sizes of the parts thus traced may be observed and preserved for reference. Also called a radiodiagram.....274, 275

Oscillation, Electric. Henry discovered that the seemingly instantaneous discharge of a Leyden jar consists in reality in a series of equal or diminishing waves, impulses or alternations, having varying periods, but having high frequency oscillations at the rate of one million per second. (See D'Arsonval)..... 139

Oudin Resonator Mode. One of high frequency, high voltage and low amperage, applied by the single pole method, with ordinary electrodes or usually the glass semi-vacuum tubes..... 251

Oxidation. The rust collected on the metal parts of the battery. Combining or causing to combine with oxygen..... 382

Oxyhemoglobin. Hemoglobin charged with oxygen in the arterial blood 379-389

Ozol. A terpene peroxide gas having a formula of $C_{10}H_{18}O_3$. An unstable compound made by the ozol machine, combining ozone (O_3) in the nascent state, with the volatile principles of terpene oils. Given by inhalation. Producing rapid oxidization of the blood. Oxidation of effete matter and increase of body temperature.....378-387, 388

Ozone. Double or triple oxygen (O_2 or O_3) liberated from air by a disruptive discharge of electrification, as lightning, static sparks, high frequency effleuve, etc. The chief product of the ozol machine entering into the composition of ozol.....379-389

Ozonizer. A machine for generating or liberating ozone from air..

Paraffine. A carbo-hydrogen obtained from petroleum and other sources. It is a white, waxy solid, not acted upon by acids or

alkalies. It is an excellent insulating substance, unequalled for its resistance to moisture. It is used to insulate wires, and a thin layer of it on the upper end of the battery elements and their metal connections prevents an accumulation of salts on them. Whenever applied for insulating purposes it should be melted and the object to which it is applied should be hot....

Parallel Connections 102, 108, 109

Para-Magnetic Bodies. Bodies attracted by a magnet.....

Passive Electricity. Electrification in a state of equilibrium. See natural electrification .....

Paste or Dry Cell.....91-92

Period. The time of a cycle.....125, 141

Periodicity. The rapidity of variations in unidirectional modes; also applied to the rectified alternated mode. Analogous to frequency in the alternated mode.....125, 141

Peripheral Electrization. Electrification applied to the external surface of the body..... 359

Permanent Magnet. Those which retain magnetic properties when removed from the source from whence they acquired it..... 310

Phagocytosis. The destruction of harmful cells, by cells called phagocytes, which develop and absorb them.....

Phoresis 84, 458

Phoric Electrode 164, 167, 174, 371

Phosphorescence. The bluish-white glow of certain substances, when exposed to the ultra-violet light emanations.....

Photo-Therapy 82, 331

Phreno-Magnetism. (A misnomer). Excitement of the organs of the brain by mesmeric passes. Suggestion.....

Physician's Induction Coil..... 116

Physiological. Natural or normal.....

Physiologic Effects of Electrification.....159, 194, 363

Pile. Originally the name given to a pile composed of discs of zinc and copper separated by a moist, porous material, constructed by Prof. Volta, hence called the Voltaic pile. It is now frequently applied to the combination of elements in battery cells.

Pile, Voltaic. The name given to a pile composed of discs of zinc and copper separated by a moist porous material. Frequently applied to the combination of elements in battery cells.....

Plantinode. Name given by Daniells to the collecting plate, platinum, carbon, copper, etc.....

Plastic. Tending to build up or form tissues, as a plastic exudate.

Plates, Recoating 210, 213, 214
Plates, X-ray 296, 307-8-9
Platinum. A metal first discovered in the mines of Choco, Peru. It is nearly of the color of silver, but less bright, and is the heaviest of metals. It is used for the collecting plate in battery cells, because it is not acted upon by the fluid..... 161, 301
Plug, Safety. A metal plug which readily fuses when too heavy a mode passes. A safety fuse.....
Poikilocytes. Malformed, over-sized, non-nucleated red blood corpuscles present in pernicious and other anemias.....
Polar. Relating to the poles.....
Polar Effects 105, 363
Polar Force. The magnetic force with which similar ends or magnets repel, and dissimilar ends attract each other. Polarity..
Polar Method. This is accomplished by placing the pole whose distinctive effect is wanted, over the part to be treated, and the other pole over some indifferent part..... 363
Polarity of Electricity. That property of electrification which causes it to exhibit attraction and repulsion.....
Polarity of Elements..... 161
Polarity of Magnets. That property which causes them when freely suspended to assume a northerly and southerly direction; also to attract dissimilar, and repel similar, poles of other magnets .....
Polarity of Nerves. The condition of a nerve in which the part nearest the negative pole, is in a state of increased, and that nearest the positive pole is on a state of diminished irritability. (See Anelectrotonus and Catelectrotonus)..... 160
Polarity Tests of Battery or Machine..... 111, 230
Polarizable. The property of exhibiting polarity under certain conditions .....
Polarization. The act of arranging the substances which form an electric circuit in polar order, that is the positive corpuscles collected together in one part of the circuit, and the negative in another, so arranged that they react on each other. The act of forming poles or points of intensity having qualities mutually opposite. The formation of a film of hydrogen gas on the negative element in a galvanic cell, insulating it and stopping the generation of an electric mode..... 87
Polarization of Elements. When the hydrogen set free in a cell is permitted to collect about the carbon, platinum or copper

plate in the fluid, there is a counter-mode set up between the gaseous envelope and the zinc within the fluid, which tends to counteract or destroy the mode passing through the external circuit, and the elements are said to be polarized..... 87
Polarizing. Giving polarity to.....
Polarizing Current. A mode which produces the electrotonic condition .....
Pole-Changer. A device for changing the direction of the mode without moving the electrodes. A commutator.....97, 285
Poles, Consecutive or Consequent. When a magnet is irregularly magnetized it frequently contains three or more poles, and the term consequent is applied to the extra poles.....
Poles, Electric. Points where electrification passes in and out....
Poles, Magnetic. Points where magnetization is concentrated....
Portable Electric Light Bath.....339, 340
Portable Electro-Vapor Bath..... 181
Portative Force. The power of a magnet to sustain weights fastened to its armature.....
Positive Breeze 202
Positive Electrification. That which is generated or set free by rubbing glass with silk. Also called vitreous..... 200
Positive Indirect Spark..... 203
Positive Insulation 200
Positive Pole. The binding post, conducting cord and electrode, connected with the carbon, copper or platinum, (electro-negative) element of the battery. The anode. The positive side or prime conductor of a static machine.....277, 282
Post, Binding. See under Binding Post.....98, 116
Potential. Electric pressure (measured in volts). A term used in electrification which is analogous to temperature in heat. It means the power of an electric force to do work..... 85
Potential. This term holds the same relation to electrification that the term level does to gravity. Just as water at a higher level tends to move to a point of lower potential. It is often used synonymously with tension, but since the latter term is used to express very diverse conditions, electricians now make use of the term potential in referring to "electric level" whether static, dynamic or magnetic.....85, 443
Potential at a Point. An abbreviation for difference of potential between the point and the earth.....
Potential, Dynamic. Difference of "electric level" between two

elements, when both are immersed in the same fluid, which acts chemically upon one of them. The same term applies to difference in electric level, produced by revolving coils of wire, between the poles of horse-shoe magnets.....
Potential (Magnetic). The potential or "electric level" due to a given magnetic pole is of precisely the same nature as that of an electrified body at that place.....
Potential (Static). This is the difference in "electric level" between an electrified body and the earth, the latter being the standard and regarded as zero.....
Potential Variations or Surging.....202, 218, 245
Pressure. Voltage or electro-motive force.....83, 86
Primary Cells 91
Primary Coil. The layers of coarse wire which form the inner coil of the helix.....114, 116, 301
Primary Current. The inducing mode from the primary coil..... 113
Prime Conductors. The poles of a static machine, usually large balls in front, supporting sliding rods..... 199, 229
Primitive Current. When two points in a closed circuit are connected by an additional conductor, a portion of the mode is drawn off. The mode, as it existed before a part is drawn off, is the primitive mode.....
Prognosis in Paralysis..... 355
Prostatic Phoric Electrode.....174, 371
Protracted Applications. The continued application of electrification by means of belts, disks, etc., for a long time..... 143
Pulsation. Variations in the unidirectional or rectified alternated modes, the rate being termed periodicity. Pulsation may be either positive or negative.....140, 202, 218, 245
Quality. Of a mode refers to the smoothness or harshness, or to the evenness, rapidity or slowness of the interruptions.....
Quantity. The amount of electrification generated in a given time. The unit of quantity is known as the "Coulomb"..... 443
Radiance. The glow or brilliancy of an X-ray tube.....
Radiant Electrification 81
Radicals. The ions or elementary particles into which the chemical compound is divided by electrolysis.....160, 238
Radio Activity 288
Radiodiagram. See orthodiagram..... 295
Radiogram. A radiograph 295
Radiograph. An X-ray picture, a print of the effect, or the shadow of the X-rays on a sensitized plate. A printed positive.... 390

Radiography. The art or science of making radiographs.....207, 293
Radiology. Radiography 207, 287
Radioscopy. Radiography 207, 287
Radio-Therapy. The science of the application of the X-rays in treatment of disease. Photo-Therapy..... 390
Reaction, Electrical. The phenomena developed in any part of the body under the influence of electrification..... 351, 356
Reaction of Degeneration..... 356
Reciprocal. The reciprocal of a fraction is the inversion of it....
Recoating Plates, Directions For.....213, 214
Rectifier. An apparatus similar to the Nodon valve, consisting of a container, and two dissimilar elements immersed in an electrolyte. It has the property of arresting the impulse of an alternating mode in one direction, but allows the impulse to pass in the opposite direction, thus delivering a pulsating unidirectional mode, having the properties of the direct or constant mode. The elements are usually aluminum and lead or iron. The surfaces of the two elements are in the proportion of one to two hundred, as to area exposed to the electrolyte, which consists of a solution of the phosphates in the strength of two pounds of the salt to a gallon of distilled or boiled water. Dibasic phosphate of ammonium for a mode of 3 amperes or more. Magnesium for 2 amperes, and sodium for one ampere 128, 130, 133, 301
Red Acid Cells..... 91
Regulator, Current. See shield 116
Regulator, Hand. A resistance box operated by hand..... 103
Regulators, Vacuum 277, 281, 282
Relay. An electro-magnetic switch.....
Relay, Polarized. A relay for telegraphic use.....
Reluctance. Magnetic reluctance is the ratio of magneto-motive force to a magnetic flux.....
Repulsion and Attraction..... 161
Residual Charge. A feeble charge of electrification which can be obtained from a Leyden jar a few minutes after it has been thoroughly discharged. Literally "the charge left over."....
Residual Magnetism. Moderately hard iron when magnetized retains some magnetic polarity; this is residual magnetism.....
Resinous Electrification. That which is excited by rubbing wax or resin with flannel or fur. Negative electrification.....

Resistance. The opposition offered to the passage of electrification, and is the quality of a conductor which impedes the action of the mode, $R = \frac{E}{C}$, Resistance equals pressure ÷ by current strength.

The unit of resistance is the ohm. The resistance is dependent on the size, length and kind, of wire in the circuit. The resistance of different metals and conductors varies, as will be seen by reference to the following table, in which pure copper is taken as the unit of comparison with a total resistance of 1.00..... 90

Metal.	Resistance.
Silver	0.77
Copper	1.00
Gold	1.38
Aluminum	2.29
Zinc	2.82
Iron	5.36
Tin	6.76
Platinum	7.35
Lead	9.96
German silver	10.09
Antimony	18.07
Mercury	47.48
Bismuth	64.52
Graphite	1106.00
Gas carbon	2037.00

Resistance, Unit Of. The Ohm..... 443

Resonator. Oudin's coil attached to a D'Arsonval solenoid, producing a mode of high frequency, high voltage and low amperage 251, 255

Reverser, Current. A pole-changer. A commutator.....97, 285

Rheochord. A metallic wire introduced into a circuit to vary the strength of the mode. A rheostat. A shunt.....95, 110

Rheometer. A galvanometer 94

Rheomotor. An apparatus by which an electrical mode is generated. A dynamo 124

Rheophore. An electrode. A conducting cord..... 290

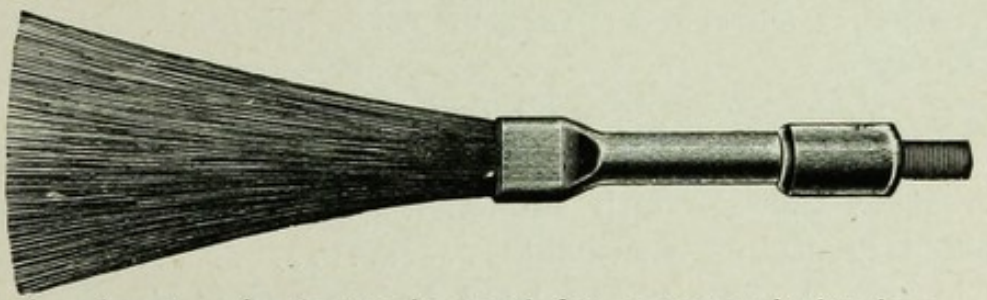
Rheoscope. A galvanoscope 94

Rheostat. An instrument for bringing a definite amount of resistance into a circuit. A mode controller. A resistance box, coil, shunt, graphite film, or column of water.....96, 103, 111, 301

Rheotome. A mode breaker. An interrupter.....96, 116, 301

Rheotrope. A pole changer, or mode reverser.....97, 285, 301

Rise and Fall.....139, 141
Roentgen Rays. The X-rays.....81, 207
Roentgengram. Radiogram. Radiograph. 390
Roentgenize. To treat by means of the X-rays..... 82
Roentgen Therapy. X-ray treatment. Radio-therapy. 82
Roentgenography. Radiography. 207, 293
Roentgenology. The science of the Roentgen or X-ray..... 82
Roentgenscopy. Radioscopy 207, 287
Roller Bearings 226
Roller Cabinet 134
Roller Massage Application..... 206
Rotary Converter. An apparatus for changing a direct to an alternating mode 146, 147
Rotary Machine. Magnetic electric machine in which electrification is generated by turning a crank, which revolves an armature, past the poles of a permanent magnet. A magneto machine. A crude sinusoidal apparatus. A simple dynamo..... 124
Rotation Electrification. 81
Rubefaciant. A scourge or wire brush electrode. A dry covered disc static electrode.....61, 352
Ruhmkorff Coil. A powerful induction coil, invented by Ruhmkorff
Safety Fuse. A soft lead wire interposed in a circuit, which will melt if a mode, too strong for safety, passes through it.....
Saturation, Limit Of..... 116
Schnee, Four Cell Bath.....183, 184
Scholtz Lamp 338
Sciagraph or Skiagraph. A term used in architecture, which is very often incorrectly used instead of radiograph, which is the proper term 390



Scourge. A wire brush electrode used for counter irritation..... **61**
Screen, X-ray 288, 289, 303, 304
Secondary Action. (See secondary electrolysis.).....
Secondary Battery. A storage battery. An accumulator..... 104
Secondary Coil. A coil of fine wire wound in many layers around the primary coil, from which it is separated by insulation, and in which the secondary mode is induced, by hysteresis....116, 301

Secondary Current. The induced mode from the secondary coil. The faradic mode 113

Secondary Electrolysis. Decomposition supposed to be accomplished by the chemical action of the elements set free by electrification. It is secondary action that causes the hydrogen to be used up by the chromic acid set free in the battery fluid, and the consequent formation of chrome alum.....

Secretory Effects 154

Sectors. Small metal discs or plates attached to the surface of the revolving plates of a static machine, which coming in contact with the brushes, excite a charge of electrification, by friction, which acts as the initial charge, and this is augmented by induction; this constituting the static electrification .....

Sedation 12, 157

Sensibility. Electro-muscular. The peculiar sensation produced in a muscle which is contracted by electrification .....

Separator. An insulating substance placed between storage battery plates to prevent short-circuiting .....

Series. The opposite to multiple or parallel, quod vide. In connecting in series, we connect zinc to carbon; in connecting in multiple, we connect zinc to zinc and carbon to carbon....99, 101, 301

Series Connection of Cells.....99, 101, 107, 301

Series, Thermo-electric. Metals so arranged, with reference to their thermo-electric properties, that each is electro-positive to any other following it .....

Sero-sanguinous. Serum and blood mixed.....

Shadowgraph. A radiograph or X-ray picture..... 390

Shellac. The resinous substance largely used as an insulator..... 90

Shield. The tube of non-magnetic metal, which slides over the core, in a faradic battery, to act as a mode regulator. A muffler. A damper 116, 117

Shield, X-ray 288, 289, 303, 304

Shock. A sudden discharge of electrification. The impression made on the nerves by opening or closing the circuit, or increasing or decreasing the strength suddenly. This should be carefully avoided in giving treatments .....

Short Circuit. A circuit completed before the mode reaches the conductors or electrodes. A metallic or other contact of little or no resistance, between the elements outside the cell. The touching together of the elements inside the cell..... 87

Shower, Static 200

Shunt. An additional path established by connecting one conductor

to another, in such a way as to deprive the first of a part of its mode. When two conductors are connected in multiple with a source of electric supply, each is said to be in shunt with the other. It is a tap.....109, 110, 221
Shunt Circuit. A part of the mode from the main electric circuit over another line, like a switch or side track beside a rail road.
Silver Cell. The chloride of silver cell.....91, 92
Sine Curve Current. The sinusoidal mode.....118, 119, 136, 139, 145
Sinusoidal Current. A smooth alternated harmonic wave mode.... 118
Skeleton of a Static Machine..... 229
Skiagram. A radiograph 390
Skiagraph. (See sciagraph.) A radiograph..... 390
Skin Map of Pain Areas.....368, 369, 376
Sledge Coil 120
Sliding Rods. The horizontal movable rods in front of a static machine, attached to the prime conductors for the purpose of regulating the spark gaps, and also to short circuit the machine.... 229
Smee Cell. A zinc-silver couple used with an electrolyte of dilute sulphuric acid .....
Soft Tube. An X-ray tube having a low vacuum.....274, 279, 284
Solenoid. A cylindrical coil of insulated copper wire, around a soft iron core, as in an induction coil, a helix. Also a larger coil connected to a high frequency generator, as the D'Arsonval solenoid. The primary of an Oudin resonator, or a Tesla generator. Also a very large coil, for giving auto-condensation, as the cage, or diasolenic..... 251
Solenoid Shunt Static Mode.....221, 225
Soluble Electrodes 175, 176, 177
Sounder. A resonator used in telegraphy, the Morse sounder being the one in general use .....
Source, Electric. A device, like a battery or a dynamo, that will produce an electro-motive force .....
Spark Gap. The space between the balls of the sliding rods of a static machine; or the prime terminals on an X-ray induction coil; or in a Crookes tube for X-ray work.....209, 287
Spark, Static 200, 201
Stabile Application. A mode applied with both electrodes in a fixed position. The opposite of labile in which one electrode is kept in motion .....
Static Applications, Ten..... 197
Static Electrification. Electrification at rest.....81, 199
Static Machine 197, 199, 225, 229

Static Technique 193, 197, 199
Static Vibrations. (Bennett method.) 217, 221
Step-Down Transformer 146
Stimulation 157
Storage Battery 104
Streamers. Static discharges from X-ray tubes, and connections, which are supposed by some, to cause burns.....
Stress 217, 221, 311, 312
Stricture Electrodes 171
Suggestions on Meters and Rheostats 94, 95
Sulphating. In storage batteries an inert sulphate of lead forms on the plates and so produces a loss of potential, this is known as sulphating .....
Supply, Unit of Electric. Known also as the Board of Trade Unit. It means 1000 watt-hours, and is the unit in charging for electrification supplied for lighting and heating. Ten amperes of a 100 volt mode, running for one hour would equal 1000 watt-hours. 10 a. times 100 volts = 1000 watts, times 1 hr. = 1000 watt-hours .....
Suppuration. Formation of pus .....
Suppurative. Tending to form pus .....
Supra. Above .....
Supra-Orbital. Above the orbit of the eye.....
Surging or Potential Variation 202, 218, 245
Swelling Mode. Gradually increasing and decreasing the mode without interrupting, repeated every minute or two..... 160
Switch. Metallic bars on a pivot, used to connect sections of cells, as mode reversers and mode selecters; or to open or close the main circuit. They form a part of the battery accessories, which are attached to the base..... 101
Switchboard. Term applied to an apparatus consisting of a wooden, rubber, slate or stone base, upon which are permanently mounted switches, posts, coils, meters, rheostats, etc. The whole comprising a table or wall plate, for therapeutic use..... 96-97- 99
Switch, Knife. A knife-edge switch by means of which a circuit may be opened or closed by contact between parallel contact plates. Used chiefly for circuits carrying heavy modes..... 111
Synchronism. The simultaneous occurrence of vibrations, pulsations, and mode reversals .....
System, Three Wire. A system, invented by Edison. Two dynamos were formerly used; but, a new method, the three-wire system is now operated by means of one dynamo..... 131, 133

Tangent Galvanometer. An instrument for the accurate measurement of the strength of the galvanic mode..... 94
Tape, Insulating. Some flexible material impregnated with rubber, arranged in ribbon form and used to cover wires and joints to insulate them .....
Target 271, 277, 282
Technique, Static 193, 197, 199
Tension. Potential. This term is applied by various authors to (1) the tendency of electrification to overcome resistance; (2) the strain put upon the circuit by the electro-motive force; (3) the difference of potential of any two points joined by a conductor. The quality; voltage; also pressure, as the pressure of blood in the arteries.....83, 86, 443
Terminal. The point where a mode of electrification enters or leaves a generator or a capacity .....
Tesla Coil. A powerful high tension compound induction coil, invented by Tesla..... 244, 251
Tesla Mode. One with very high frequency, very high voltage and very low amperage. Usually a part of the portable high frequency and X-ray coils. By some, termed thermo-faradic. Resembles the D'Arsonval, but having much less amperage.... 244
Testing Tubes 274
Tetanization. The production of a contracted or tetanic condition in a muscle or nerve, or temporary paralysis in a nerve, by an electric mode .....
Therapeutic, Electro, Index of Treatments.....19, 78
Thermic Effects 156, 363
Thermo-Electrification. Electrification that is generated when two metals are soldered together so as to form a closed circuit, and one of the junctions is heated more than the other.....
Thermo-Electric Bath 178, 180
Thermo-Faradic Mode. A term used by some for the Tesla mode.
Thermostat. An apparatus responsive to changes of temperature, causing expansion and contraction, and by this property used to control or regulate mechanism. Used for measuring electric mode. The "hot wire meter" used to measure high frequency modes is of this type..... 263
Time Cut-Off, Automatic. A device used with a storage battery to throw it in circuit or cut it out, at certain times .....
Time of Radiograph Exposures..... 296

To and Fro Current. The interrupted, or faradic mode..... 113
Topography, Anatomical 364
Body pains 368, 369
Head pains 376
Torpedo. The electric ray, a species of fish found in the Mediterranean .....
Torque. The mechanical twisting or rotary force which acts upon the armature of a dynamo or motor .....
Transformer. A kind of induction coil. An apparatus used to raise or lower the voltage of an alternating electric mode before distribution for lighting and therapeutic use. There are several kinds known as step-down, step-up, sinusoidal, cautery, welding, faradic, X-ray, etc.....116, 146
Transformer, Step-Down. A transformer for converting a small mode of high voltage into a large mode of low voltage. The opposite to step-up transformer..... 146
Transformer, Step-Up. A transformer for converting a large mode of low voltage to a small mode of high voltage. Physicians' induction or Faradic coils, sinusoidal and X-ray coils are of this type 116
Transformer, Cautery. A step-down induction coil; the ordinary faradic coil reversed, having a coarse coil outside, around a fine coil; by passing a high voltage mode through the outer coil, a lower voltage mode is derived from the inner coil, by induction, which is used for heating cautery, knives, points, snare, etc.
Transformer, Welding. A kind of step-down transformer for converting a light mode of high pressure into a heavy mode of low pressure, suitable for electric welding .....
Tray Cell. A gravity cell, named from its shape.....91, 93
Trembler. A vibrator, or interrupter on an induction coil..... 116
Tube Holder. A clamp, with a heavy base, for holding an X-ray tube 289, 291, 292
Tubes, X-Ray 272, 276, 281, 309
Turn, Ampere. One single turn in a coil of wire through which one ampere passes. We use this term to denote the electrical power which is being expended in producing magnetization. The "ampere turns" of an electro-magnet are the product of the number of turns of wire, times the number of amperes flowing through the coil .....
Two Fluid Cell. A cell in which a different fluid is used with each element 93

Ultra-Violet Rays. Rays invisible, because beyond the violet of the spectrum 257, 338

Uniform Current. A mode that is kept at the same strength during the application .....

Uninterrupted Current. The galvanic or direct, or constant mode.

Unipolar. Connected to one pole; same as monopolar..... 258

Unipolar Applications. (See polar method) 353

Units, Absolute. They are based upon units of mass (gramme), length (meter), and time (second). .....

Units and Standards .....

Capacity	The farad
Force	The dyne
Induction	The henry
Intensity of field	The gauss
Length	The centimeter
Potential, push, pressure	The volt
Power (horse) (energy)	The watt
Quantity	The coulomb
Resistance	The ohm
Strength (current)	The ampere (weber)
Time	The second
Weight, or mass	The gramme
Work	The joule (erg)

Unpolarizable Electrodes. Those made of pure amalgamated zinc or zinc that has been immersed in a syrup solution of sulphate of zinc. Used in delicate physiological experiments..... 88

Unpolarized. Not possessing polarity .....

Upward Current. Term applied to the mode when it passes from the branches toward the trunk or root of a nerve. The negative pole is placed on the trunk, the positive on the branches..... 159

Vacuum. A space from which the air has been partially exhausted.

Vacuum Electrodes. Hollow glass electrodes of different shapes from which the air has been more or less exhausted before the end of the electrode is sealed. Used in giving therapeutic treatments of the various high frequency modes. Usually attached to an Oudin resonator, and applied by the single pole method. Low vacuum tubes generate heat, are red or pink color, and are sedative. Medium vacuum tubes are blue or blue-white, generate chemical rays (ultra-violet) and are more stimulating. High vacuum tubes are white color, and generate X-rays..... 257

Vacuum Regulators 277

Vacuum Tubes. X-ray or Crookes or Geissler tubes from which the air is nearly all pumped.....207, 257, 277
Variations of Potential, or Surging.....202, 218
Varicocele Clamp Electrode..... 167
Vapor Bath Cabinet.....178, 180, 337
Vaso Motor Effects.....153, 159
Vibrator. The hammer or trembler or armature and the pendulum spring of an induction coil.....116, 117
Vibration Electrification 81
Vibration, Static 217, 221
Violet Light Therapy.....341, 345
Vitreous Electrification. That excited by friction of glass with silk. Positive electrification
Volt. The unit of electro-motive force, potential, or pressure..... 86
Voltage. Electro-motive force, potential, or pressure. E = C x R. Voltage = amperage multiplied by resistance..... 83
Voltaic Alternatives. When a pole changer is introduced into a circuit, so as to break not only the circuit, but to change the direction at every break, the method has been named voltaic alternatives. This is probably the most powerful muscular stimulant 125, 128, 139, 141
Voltaic Pile. The compound galvanic circle invented by Volta in 1800. Described in the text
Volt-Ammeter. A watt-meter. It is an instrument for measuring the energy of an electric mode directly in watts. A combined voltmeter and amperemeter.....
Voltmeter. An apparatus for measuring the pressure or voltage of a dynamic mode .....
Wall Plate 122, 123
Water Soluble Electrodes 177
Water Special Electrodes 166
Watt. The unit of power required in the work done by one ampere of mode, when forced by one volt of pressure. Watt = amperes x volts. W = A. x V. 746 watts = one horse power, which is the amount of energy required to lift 33,000 pounds one foot high, in one minute. Horse power of electric mode = amperes multiplied by volts, divided by 746. H. P. = A. x V. ÷ 746..... 443
Wattmeter. An instrument for measuring the work done.....
Wave Generator, Magnetic 319-326
Weber. A name formerly given to what we now term the ampere.
Welding, Electric. Welding of metals by means of electrification.

Wire, Dead. A wire over which no mode is passing at the time.

Wire, Fuse. A safety fuse placed in a safety catch, as a protection against an excess of dose .....

Wire-Gauge. A gauge with notches on its edge, or circumference, which are standard for the thickness or wire, sheet metal, etc. See B. W. G. and B. & S. in glossary .....

Wires, Leading-In. The wires which conduct the mode in and out of an incandescent lamp .....

Wire, Live. A wire over which a mode of electrification is passing.

Wire, Negative. The wire connected with the negative pole of a battery or dynamo .....

Wire, Pilot. Wires leading directly to the central station, from distant points of a circuit, in incandescent systems. By means of these wires the voltage at such points may be watched .....

Wire, Positive. The wire connected with the positive pole.....

Wire, Return. The wire by which a mode returns to its source after completing the circuit .....

Wire, Span. The wire used to hold up the wire for the trolley car.

Wire, Trolley. The over head wire from which electrification is taken to operate the motors of trolley cars .....

X-Radiography 207, 287

X-Rays. The unknown quantity. The invisible light discovered by Roentgen, Nov. 8th, 1895. An ultra-violet light penetrating opaque substances. Not deflected, reflected or refracted....82, 270

X-Ray Burns. A dermatitis caused by too close, or too frequent, or too long continued exposure of the skin to the action of the X-rays 392

X-Ray Coil 262, 268, 284, 298

X-Ray Pictures. Radiographs. Shadowgraphs. Positive prints from an X-ray negative.....207, 390

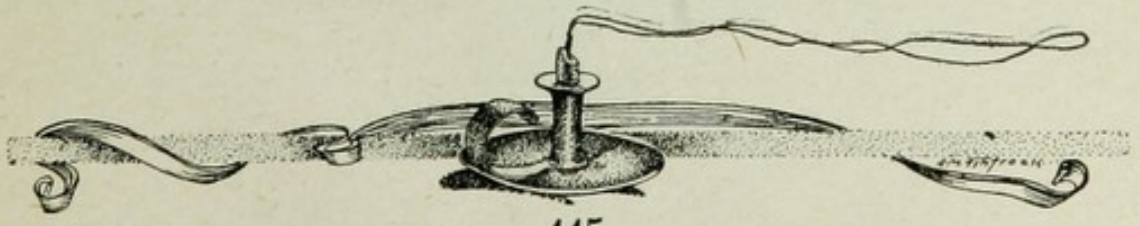
X-Ray Plates 296

X-Ray Shield, Allen's 289

X-Ray Tube. A Crookes tube.....207, 272, 276, 281, 309

Zinc. A metal used as the positive element in a galvanic battery cell.

Zinc, Amalgamation of. Zinc covered with a thin coating of mercury 88



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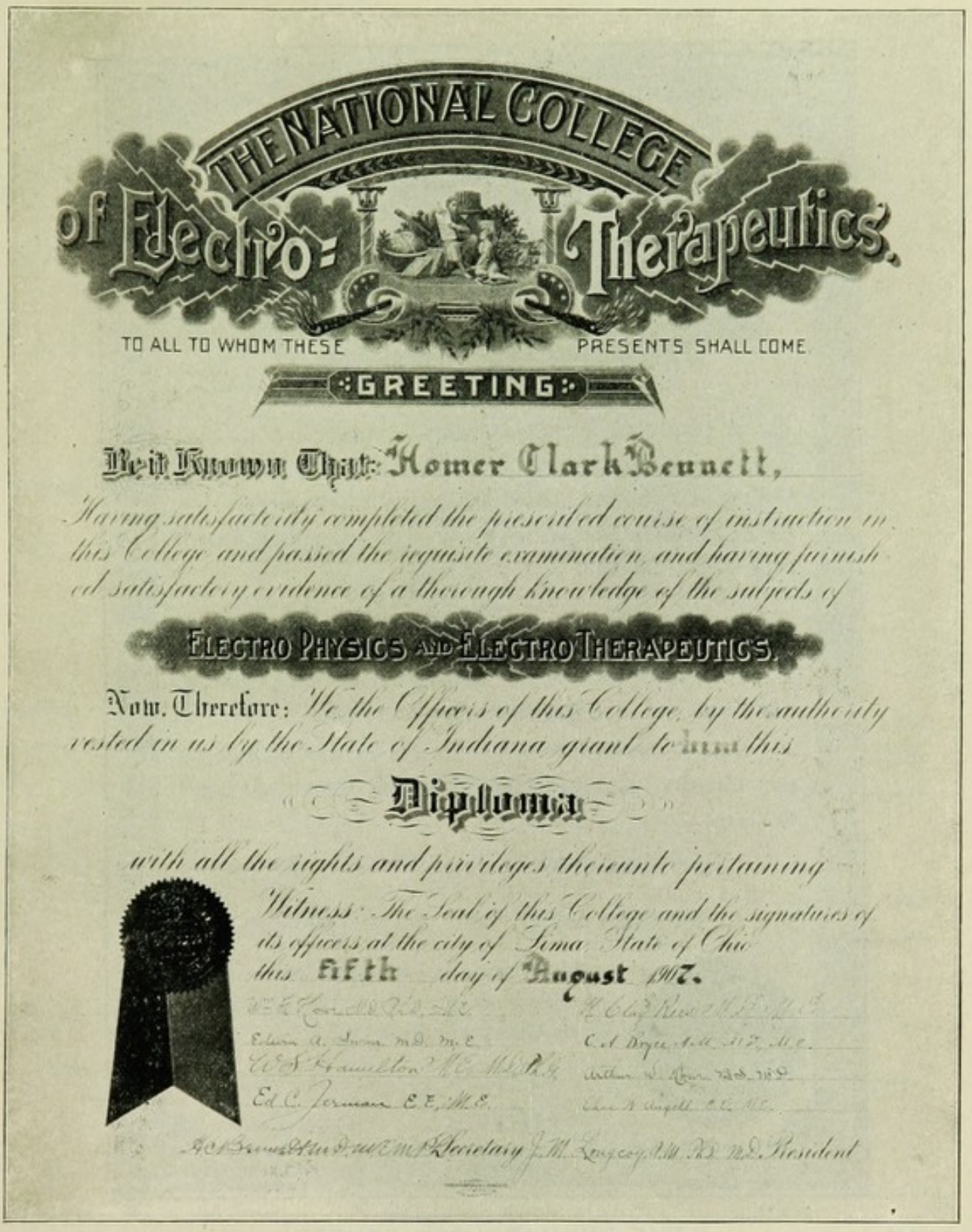
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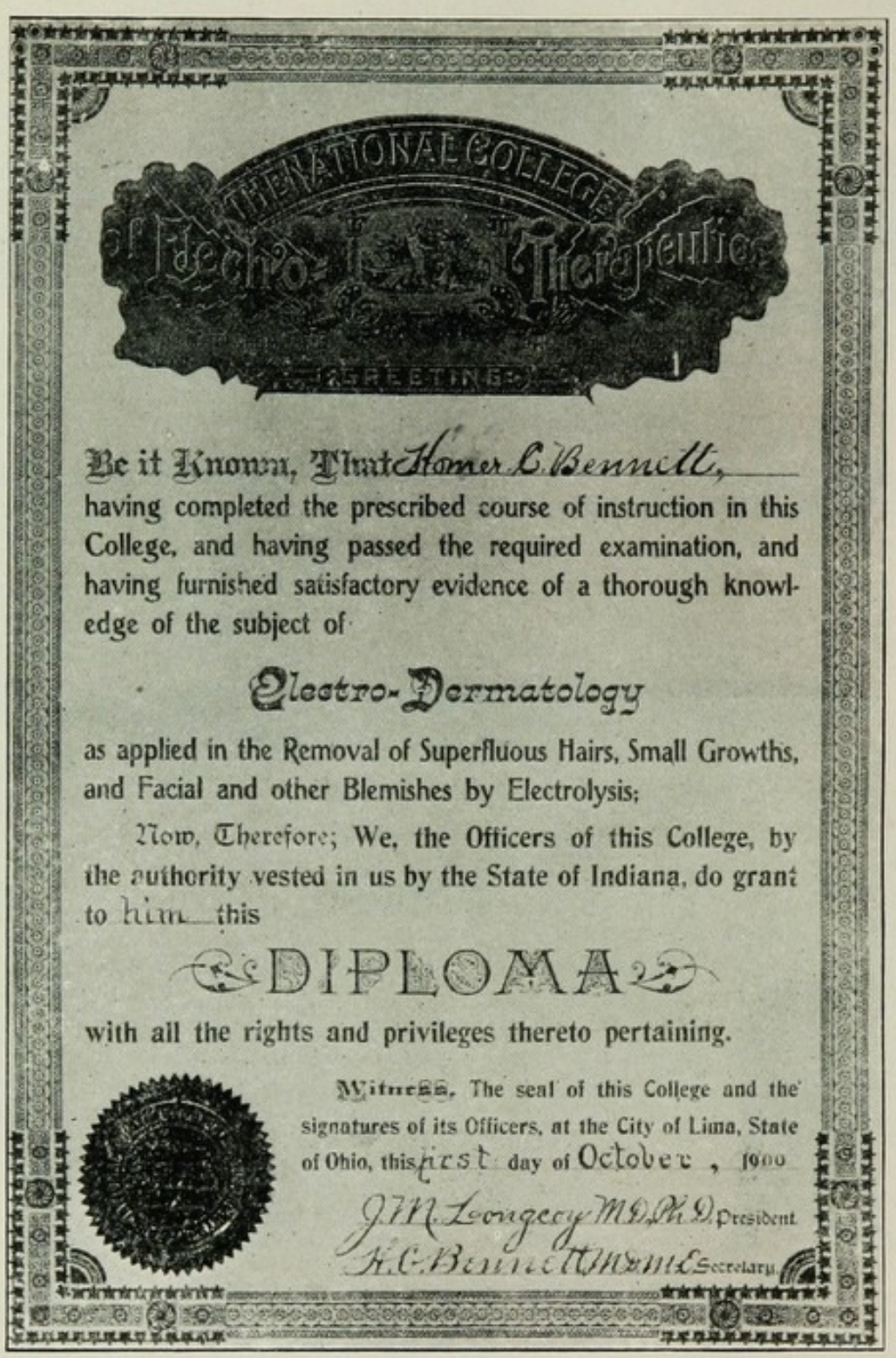
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